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01 AERONAUTICS (GENERAL)

N76-31134*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL STUDY AND WIND TUNNEL TESTS OF AN AEROMECHANICAL GUST-ALLEVIATION SYSTEM FOR A LIGHT AIRPLANE
Eric C. Stewart Washington Aug. 1976 82 p refs
(NASA-TN-D-8234; L-10635) Avail: NTIS HC $5.00 CSCL 01C

The results of an analytical study of a system using stability derivatives determined in static wind tunnel tests of a 1/6 scale model of a popular, high wing, light airplane equipped with the gust alleviation system are reported. The longitudinal short period mode dynamics of the system are analyzed, and include the following: (1) root loci, (2) airplane frequency responses to vertical gusts, (3) power spectra of the airplane responses in a gust spectrum, (4) time history responses to vertical gusts, and (5) handling characteristics. The system reduces the airplane's normal acceleration response to vertical gusts while simultaneously increasing the pitching response and reducing the damping of the longitudinal short period mode. The normal acceleration response can be minimized by using the proper amount of static alleviation and a fast response system with a moderate amount of damping. The addition of a flap elevator interconnect or a pitch damper system further increases the alleviation while moderating the simultaneous increase in pitching response. The system provides direct lift control and may reduce the stick fixed longitudinal static stability. Author

N76-31135*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ADVANCED CONTROL TECHNOLOGY AND ITS POTENTIAL FOR FUTURE TRANSPORT AIRCRAFT
Washington Aug. 1976 1005 p refs Presented at a Symp. on Adv. Control Technol., Los Angeles, 9-11 Jul. 1974
(NASA-TM-X-3409; H-904) Avail: NTIS HC $28.25 CSCL 01C

The topics covered include fly by wire, digital control, control configured vehicles, applications to advanced flight vehicles, advanced propulsion control systems, and active control technology for transport aircraft. For individual titles, see N76-31136 through N76-31178.

N76-31136* National Aeronautics and Space Administration, Washington, D.C.
NASA ADVANCED CONTROL TECHNOLOGY: AN OVERVIEW **c08**
Peter R. Kurzhals *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

NASA's current and projected advanced control technology programs for future transport aircraft include the design and verification of full flight envelope autopilots, the development and flight test of all-digital fly by wire systems, the evolution of low cost innovative avionics concepts such as split surface stability augmentation systems, the evaluation of integrated propulsion control and cooperative autopilot/propulsion control systems, the application of active control systems to short haul and long haul transports, and the demonstration of reconfigured active control aircraft. Key technical features and anticipated contributions of these technologies are outlined. Author

N76-31137* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SURVIVABLE FLIGHT CONTROL SYSTEM FLY-BY-WIRE DEVELOPMENT AND FLIGHT TEST **c08**
James E. Hunter *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 41-56 refs (For availability see N76-31135 22-01)
CSCL 01C

Results from an intensive FBW advanced development effort indicate significant improvements in overall flight control system performance, reliability, safety and maintainability. Additionally, the strong and credible FBW technology base developed as a result paved the way for further exploitation through the application of advanced concepts such as control configured vehicles and multi-mode controls. Author

N76-31138* General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DEVELOPMENT OF AN ACTIVE FLY-BY-WIRE FLIGHT CONTROL SYSTEM **c08**
Charles A. Anderson *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 57-71 (For availability see N76-31135 22-01)
CSCL 01C

A summary of the YF-16 flight control system is presented. The basic functions of the flight control system are discussed, as well as the unique features such as Relaxed Static Longitudinal Stability (RSS), Fly By Wire (FBW), and Side Stick Pilot's Controller (SSC). In addition, the basic philosophy behind the selection of the flight control system functions and unique features is discussed. Author

N76-31139* Boeing Co., Wichita, Kans.
B-52 CONTROL CONFIGURED VEHICLES: FLIGHT TEST RESULTS **c05**
James I. Arnold and Frank B. Murphy *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 75-89 refs (For availability see N76-31135 22-01)
CSCL 01C

Recently completed B-52 Control Configured Vehicles (CCV) flight testing is summarized, and results are compared to analytical predictions. Results are presented for five CCV system concepts: ride control, maneuver load control, flutter mode control, augmented stability, and fatigue reduction. Test results confirm analytical predictions and show that CCV system concepts achieve

performance goals when operated individually or collectively.
Author

N76-31140* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN OVERVIEW OF NASA'S DIGITAL FLY-BY-WIRE TECHNOLOGY DEVELOPMENT PROGRAM **c08**
Calvin R. Jarvis *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 93-103 refs (For availability see N76-31135 22-01)
CSCL 01C

The feasibility of using digital fly by wire systems to control aircraft was demonstrated by developing and flight testing a single channel system, which used Apollo hardware, in an F-8C test airplane. This is the first airplane to fly with a digital fly by wire system as its primary means of control and with no mechanical reversion capability. The development and flight test of a triplex digital fly by wire system, which will serve as an experimental prototype for future operational digital fly by wire systems, are underway.
Author

N76-31141* National Aeronautics and Space Administration. Hugh L Dryden Flight Research Center, Edwards, Calif.
DESIGN AND DEVELOPMENT EXPERIENCE WITH A DIGITAL FLY-BY-WIRE CONTROL SYSTEM IN AN F-8C AIRPLANE **c08**
Dwain A. Deets *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 105-132 refs (For availability see N76-31135 22-01)
CSCL 01C

To assess the feasibility of a digital fly by wire system, the mechanical flight control system of an F-8C airplane was replaced with a digital primary system and an analog backup system. The Apollo computer was used as the heart of the primary system. This paper discusses the experience gained during the design and development of the system and relates it to active control systems that are anticipated for future civil transport applications.
Author

N76-31142* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
MECHANIZATION OF AND EXPERIENCE WITH A TRIPLEX FLY-BY-WIRE BACKUP CONTROL SYSTEM **c08**
Wilton P. Lock, William R. Petersen, and Gaylon B. Whitman (Sperry Flight Systems Div.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 133-163 refs (For availability see N76-31135 22-01)
CSCL 01C

A redundant three axis analog control system was designed and developed to back up a digital fly by wire control system for an F-8C airplane. The mechanization and operational experience with the backup control system, the problems involved in synchronizing it with the primary system, and the reliability of the system are discussed. The backup control system was dissimilar to the primary system, and it provided satisfactory handling through the flight envelope evaluated. Limited flight tests of a variety of control tasks showed that control was also satisfactory when the backup control system was controlled by a minimum displacement (force) side stick. The operational reliability of the F-8 digital fly by wire control system was satisfactory, with no unintentional downmodes to the backup control system in flight. The ground and flight reliability of the system's components is discussed.
Author

N76-31143* Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MAN-RATED FLIGHT SOFTWARE FOR THE F-8 DFBW PROGRAM **c08**
Robert R. Bairnsfather *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 165-198 refs (For availability see N76-31135 22-01)
CSCL 01C

The design, implementation, and verification of the flight control software used in the F-8 DFBW program are discussed. Since the DFBW utilizes an Apollo computer and hardware, the procedures, controls, and basic management techniques employed are based on those developed for the Apollo software system. Program assembly control, simulator configuration control, erasable-memory load generation, change procedures and anomaly reporting are discussed. The primary verification tools are described, as well as the program test plans and their implementation on the various simulators. Failure effects analysis and the creation of special failure generating software for testing purposes are described.
Author

N76-31144* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT TEST EXPERIENCE WITH THE F-8 DIGITAL FLY-BY-WIRE SYSTEM **c08**
Kenneth J. Szalai *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 199-252 refs (For availability see N76-31135 22-01)
CSCL 01C

Flight test results of the F-8 digital fly by wire control system are presented and the implications for application to active control technology are discussed. The F-8 DFBW system has several of the attributes of proposed ACT systems, so the flight test experience is helpful in assessing the capabilities of those systems. Topics of discussion include the predicted and actual flight performance of the control system, assessments of aircraft flying qualities and other piloting factors, software management and control, and operational experience.
Author

N76-31145* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A PILOT'S OPINION OF THE F-8 DIGITAL FLY-BY-WIRE AIRPLANE **c08**
Gary E. Krier *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 253-267 ref (For availability see N76-31135 22-01)
CSCL 01C

The handling qualities of the F-8 digital fly by wire airplane are evaluated by using the Cooper-Harper rating scale. The reasons for the ratings are given, as well as a short description of the flying tasks. It was concluded that the handling qualities of the airplane were good in most situations, although occasional ratings of unsatisfactory were given.
Author

N76-31146* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE DIGITAL FLIGHT CONTROL SYSTEM **c18**
Glenn M. Minott (Rockwell Intern. Corp.), John B. Peller (Rockwell Intern. Corp.), and Kenneth J. Cox *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 271-294 (For availability see N76-31135 22-01)
CSCL 22B

The space shuttle digital, fly by wire, flight control system presents an interesting challenge in avionics system design. In residence in each of four redundant general purpose computers at lift off are the guidance, navigation, and control algorithms for the entire flight. The mission is divided into several flight segments: first stage ascent, second stage ascent; abort to launch site, abort once around; on orbit operations, entry, terminal area energy management; and approach and landing. The FCS is complicated in that it must perform the functions to fly the shuttle as a boost vehicle, as a spacecraft, as a reentry vehicle, and as a conventional aircraft. The crew is provided with both manual and automatic modes of operations in all flight phases including touchdown and rollout.
Author

N76-31147* Lockheed Aircraft Corp., Marietta, Ga.
HISTORICAL REVIEW OF C-5A LIFT DISTRIBUTION CONTROL SYSTEMS **c05**
T. E. Disney and D. C. Eckholdt (Wright-Patterson AFB, Ohio) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 295-323 refs (For availability see N76-31135 22-01)
CSCL 01C

Analytical and experimental development work on various load alleviation systems for the C-5A is reviewed to trace the development of the technical and hardware concepts to the present time. Variations in system objectives, means of implementation and effects on loads and airplane performance, stability and control are discussed.
Author

N76-31148* Lockheed Aircraft Corp., Marietta, Ga.
THE C-5A ACTIVE LIFT DISTRIBUTION CONTROL SYSTEM c08
William J. Hargrove *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 295-351 (For availability see N76-31135 22-01)
CSCL 01C

The ALDCS development and design tasks, ALDCS functional configuration, and resulting challenges encountered while accomplishing the first phase of the program are described. These tasks are establishing system requirements and criteria and synthesizing a system mechanization to meet the desired load alleviation, stability margins, flight safety, and flying qualities performance. Results of the ALDCS development and prototype system flight simulation programs, and control law optimization including system stability, handling qualities and structural load analyses are presented, along with concluding remarks relative to the system design integration. Author

N76-31149* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACTIVE CONTROLS FOR RIDE SMOOTHING c08
D. William Conner and Glenn O. Thompson (Boeing Co., Wichita, Kans.) *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 353-371 refs (For availability see N76-31135 22-01)
CSCL 01C

Active controls technology offers great promise for significantly smoothing the ride, and thus improving public and air carrier acceptance, of certain types of transport aircraft. Recent findings which support this promise are presented in the following three pertinent areas: (1) Ride quality versus degree of traveler satisfaction; (2) significant findings from a feasibility study of a ride smoothing system; and (3) potential ride problems identified for several advanced transport concepts. Author

N76-31150* Boeing Commercial Airplane Co., Seattle, Wash.
USE OF ACTIVE CONTROL TECHNOLOGY TO IMPROVE RIDE QUALITIES OF LARGE TRANSPORT AIRCRAFT c08
Gerald C. Cohen, Clifford J. Cotter, and Donald L. Taylor *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 373-407 refs (For availability see N76-31135 22-01)
CSCL 01C

Analyses, construction and flight testing of two systems: Beta-vane and Modal Suppression Augmentation System (MSAS), which were developed to suppress gust induced lateral accelerations of large aircraft, are described. The 747 transport was used as the test vehicle. The purpose of the Beta-vane system is to reduce acceleration levels at the dutch roll frequency whereas the function of the MSAS system is to reduce accelerations due to flexible body motions caused by turbulence. Data from flight test, with both systems engaged shows a 50 to 70 percent reduction in lateral aft body acceleration levels. Furthermore, it is suggested that present day techniques used for developing dynamic equations of motion in the flexible mode region are limited. Author

N76-31151* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DECOUPLING CONTROL TECHNOLOGY FOR MEDIUM STOL TRANSPORTS c08
Daniel K. Bird and Terry L. Neighbor *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 409-429 refs (For availability see N76-31135 22-01)
CSCL 01C

The advanced control technology is considered that is necessary to cope with the medium STOL transport landing problem and, in particular, the necessity to decouple with active control techniques. It is shown that the need to decouple is independent of the powered lift concept but that the provisioning for decoupling is most greatly dependent on the preassumed piloting technique. The implications of decoupling and active control techniques with respect to pilot technique options, handling quality criteria, flight control mechanization, and the use of piloted simulation as a design tool, are also discussed. Author

N76-31152* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
POTENTIAL BENEFITS OF PROPULSION AND FLIGHT CONTROL INTEGRATION FOR SUPERSONIC CRUISE VEHICLES c05
Donald T. Berry and William G. Schweikhard *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 433-452 refs (For availability see N76-31135 22-01)
CSCL 01C

Typical airframe/propulsion interactions such as Mach/altitude excursions and inlet unstarts are reviewed. The improvements in airplane performance and flight control that can be achieved by improving the interfaces between propulsion and flight control are estimated. A research program to determine the feasibility of integrating propulsion and flight control is described. This program includes analytical studies and YF-12 flight tests. Author

N76-31153* Boeing Aerospace Co., Seattle, Wash.
IPCS IMPLICATIONS FOR FUTURE SUPERSONIC TRANSPORT AIRCRAFT c05
L. O. Billig, J. Kniat (Pratt and Whitney Aircraft, East Hartford, Conn.), and R. D. Schmidt (Honeywell, Inc., Minneapolis, Minn.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 453-475 (For availability see N76-31135 22-01)
CSCL 01C

The Integrated Propulsion Control System (IPCS) demonstrates control of an entire supersonic propulsion module - inlet, engine afterburner, and nozzle - with an HDC 601 digital computer. The program encompasses the design, build, qualification, and flight testing of control modes, software, and hardware. The flight test vehicle is an F-111E airplane. The L.H. inlet and engine will be operated under control of a digital computer mounted in the weapons bay. A general description and the current status of the IPCS program are given. Author

N76-31154* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DIGITAL COMPUTER PROPULSION CONTROL FACILITY: DESCRIPTION OF CAPABILITIES AND SUMMARY OF EXPERIMENTAL PROGRAM RESULTS c05
John R. Zeller, Dale J. Arpasi, and Bruce Lehtinen *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 477-501 refs (For availability see N76-31135 22-01)
CSCL 01C

Flight weight digital computers are being used today to carry out many of the propulsion system control functions previously delegated exclusively to hydromechanical controllers. An operational digital computer facility for propulsion control mode studies has been used successfully in several experimental programs. This paper describes the system and some of the results concerned with engine control, inlet control, and inlet engine integrated control. Analytical designs for the digital propulsion control modes include both classical and modern/optimal techniques. Author

N76-31155* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION AND TEST RESULTS OF A DIGITAL SUPERSONIC PROPULSION SYSTEM INTEGRATED CONTROL c07
Peter G. Batterton, Dale J. Arpasi, and Robert J. Baumbick *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 503-524 refs (For availability see N76-31135 22-01)
CSCL 01C

A digitally implemented integrated inlet/engine control system was developed and tested on a mixed compression, Mach 2.5, supersonic inlet and augmented turbofan engine. The control matched engine airflow to available inlet airflow so that in steady state, the shock would be at the desired location, and the overboard bypass doors would be closed. During engine induced transients,

such as augmentor lights and cutoffs, the inlet operating point was momentarily changed to a more supercritical point to minimize unstarts. The digital control also provided automatic inlet restart. Author

N76-31156* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FLIGHT INVESTIGATION OF A TERMINAL AREA NAVIGATION AND GUIDANCE CONCEPT FOR STOL AIRCRAFT **c04**
D. W. Smith, F. Neuman, D. M. Watson, and G. H. Hardy *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 17G

A digital avionics system was installed in the CV-340 transport aircraft. Flight tests were made to obtain preliminary performance data in the manual flight director mode using time controlled guidance. These tests provide a basis for selection of terminal area guidance, navigation, and control system concepts for short haul aircraft and for investigating operational procedures. Author

N76-31157* Boeing Commercial Airplane Co., Seattle, Wash.
SOME SYSTEM CONSIDERATIONS IN CONFIGURING A DIGITAL FLIGHT CONTROL - NAVIGATION SYSTEM **c04**
J. H. Boone and G. R. Flynn *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 17G

A trade study was conducted with the objective of providing a technical guideline for selection of the most appropriate computer technology for the automatic flight control system of a civil subsonic jet transport. The trade study considers aspects of using either an analog, incremental type special purpose computer or a general purpose computer to perform critical autopilot computation functions. It also considers aspects of integration of noncritical autopilot and autothrottle modes into the computer performing the critical autoland functions, as compared to the federation of the noncritical modes into either a separate computer or with a R-Nav computer. The study is accomplished by establishing the relative advantages and/or risks associated with each of the computer configurations. Author

N76-31158* Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DESIGN OF A CONTROL CONFIGURED TANKER AIRCRAFT **c05**
Stephen A. Walker *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

The benefits that accrue from using control configured vehicle (CCV) concepts were examined along with the techniques for applying these concepts to an advanced tanker aircraft design. Reduced static stability (RSS) and flutter mode control (FMC) were the two primary CCV concepts used in the design. The CCV tanker was designed to the same mission requirements specified for a conventional tanker design. A seven degree of freedom mathematical model of the flexible aircraft was derived and used to synthesize a lateral stability augmentation system (SAS), a longitudinal control augmentation system (CAS), and a FMC system. Fatigue life and cost analyses followed the control system synthesis, after which a comparative evaluation of the CCV and conventional tankers was made. This comparison indicated that the CCV weight and cost were lower but that, for this design iteration, the CCV fatigue life was shorter. Also, the CCV crew station acceleration was lower, but the acceleration at the boom operator station was higher relative to the corresponding conventional tanker. Comparison of the design processes used in the CCV and conventional design studies revealed that they were basically the same. Author

N76-31159* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
STUDY OF AN ACT DEMONSTRATOR WITH SUBSTANTIAL PERFORMANCE IMPROVEMENTS USING A REDESIGNED JETSTAR **c05**
Roy H. Lange (Lockheed-Georgia Co.) and Dwain A. Deets *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

The feasibility was studied of modifying a JetStar airplane into a demonstrator of benefits to be achieved from incorporating active control concepts in the preliminary design of transport type aircraft. Substantial benefits are shown in terms of fuel economy and community noise by virtue of reduction in induced drag through use of a high aspect ratio wing which is made possible by a gust alleviation system. An intermediate configuration was defined which helps to isolate the benefits produced by active controls technology from those due to other configuration variables. Author

N76-31160* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUMMARY OF THE APPLICATION OF ACTIVE CONTROLS TECHNOLOGY IN THE ATT SYSTEM STUDIES **c05**
R. V. Hood *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

The application of active controls technology to subsonic, long-range transport aircraft was investigated in three Advanced Transport Technology system studies. Relaxed stability requirements, maneuver and gust load alleviation, and active flutter suppression were the concepts considered. A different configuration was investigated for each of the three airframe manufacturers, and each had a somewhat different approach to the application of active controls technology. Consequently, the results varied in magnitude between the contractors, but several trends were noted. Relaxed stability requirements resulted in the largest benefits - reduced weight, increased return on investment, and decreased direct operating costs. Maneuver load alleviation, gust load alleviation, and flutter suppression resulted in much smaller benefits. Prior to application of active controls technology, a research and development program directed toward fulfilling data base requirements, establishing effective design techniques and criteria, improving systems maintainability and reliability, and demonstrating technology readiness must be completed. Author

N76-31161* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SURVEY OF ACTIVE CONTROLS BENEFITS TO SUPERSONIC TRANSPORTS **c05**
Kermit G. Pratt *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 ref (For availability see N76-31135 22-01)
CSCL 01C

Results are drawn from studies of the impact of advanced technologies on the design of an arrow-wing configuration. Information presented includes estimated benefits, effects of combinations of active control concepts, and constraints. Emphasis is placed on characteristics that are uniquely related to a large airframe featuring a slender body with a fixed wing of low aspect ratio, high sweep, and small thickness ratio. Author

N76-31162* Boeing Commercial Airplane Co., Seattle, Wash.
ESTABLISHING CONFIDENCE IN CCV/ACT TECHNOLOGY **c05**
Richard B. Holloway and Henry A. Shomber *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

Despite significant advancements in controls configured vehicles/active controls technology (CCV/ACT) in the past decade, few applications of this promising technology have appeared in recent aircraft designs. The status of CCV/ACT is summarized, and some of the constraints which are retarding its wider application are described. Suggestions toward establishing an increased level of confidence in the technology are given. Author

N76-31163* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ACTIVE CONTROL TRANSPORT DESIGN CRITERIA **c05**

Bertrand M. Hall and Robert B. Harris (Douglas Aircraft Co., Santa Monica, Calif.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 677-705 refs (For availability see N76-31135 22-01)
CSCL 01C

Vehicle design considerations for active control applications to subsonic transports are examined. Active control is defined along with those functions which are considered in the study of design criteria. The FAA regulations governing transport aircraft design are briefly discussed. Author

N76-31164* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED CONTROL TECHNOLOGY AND AIRWORTHINESS FLYING QUALITIES REQUIREMENTS c03
C. Thomas Snyder *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 707-733 refs (For availability see N76-31135 22-01)
CSCL 01C

Flying quality requirements are specified in terms of the complete pilot-airframe-systems loop, the task, and the environment. Results from a study of flying qualities are reported. A review of the treatment of failure cases in various flying quality requirements is presented along with a description of the methods used and relevant lessons learned from recent Autoland certification programs. Author

N76-31165* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
HANDLING QUALITIES REQUIREMENTS FOR CONTROL CONFIGURED VEHICLES c08
R. J. Woodcock and F. L. George *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 735-746 refs (For availability see N76-31135 22-01)
CSCL 01C

The potential effects of fly by wire and control configured vehicle concepts on flying qualities are considered. Failure mode probabilities and consequences, controllability, and dynamics of highly augmented aircraft are among the factors discussed in terms of design criteria. Author

N76-31166* Lockheed-California Co., San Diego.
THE F-12 SERIES AIRCRAFT APPROACH TO DESIGN FOR CONTROL SYSTEM RELIABILITY c05
F. L. Schenk and J. R. McMaster *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 749-760 (For availability see N76-31135 22-01)
CSCL 01C

The F-12 series aircraft control system design philosophy is reviewed as it pertains to functional reliability. The basic control system, i.e., cables, mixer, feel system, trim devices, and hydraulic systems are described and discussed. In addition, the implementation of the redundant stability augmentation system in the F-12 aircraft is described. Finally, the functional reliability record that has been achieved is presented. Author

N76-31167* Boeing Co., Wichita, Kans.
B-52 STABILITY AUGMENTATION SYSTEM RELIABILITY c08
T. C. Bowling and L. W. Key *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 761-778 refs (For availability see N76-31135 22-01)
CSCL 01C

The B-52 SAS (Stability Augmentation System) was developed and retrofitted to nearly 300 aircraft. It actively controls B-52 structural bending, provides improved yaw and pitch damping through sensors and electronic control channels, and puts complete reliance on hydraulic control power for rudder and elevators. The system has experienced over 300,000 flight hours and has exhibited service reliability comparable to the results of the reliability test program. Development experience points out numerous lessons with potential application in the mechanization and development of advanced technology control systems of high reliability. Author

N76-31168* Lockheed-California Co., San Diego.
LOCKHEED L-1011 AVIONIC FLIGHT CONTROL REDUNDANT SYSTEMS c05
E. O. Throndsen *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 779-802 refs (For availability see N76-31135 22-01)
CSCL 01C

The Lockheed L-1011 automatic flight control systems - yaw stability augmentation and automatic landing - are described in terms of their redundancies. The reliability objectives for these systems are discussed and related to in-service experience. In general, the availability of the stability augmentation system is higher than the original design requirement, but is commensurate with early estimates. The in-service experience with automatic landing is not sufficient to provide verification of Category 3 automatic landing system estimated availability. Author

N76-31169* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE ACT TRANSPORT: PANACEA FOR THE 80'S OR DESIGNER'S ILLUSION (PANEL DISCUSSION) c05
In its Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 805-827 (For availability see N76-31135 22-01)
CSCL 01C

A panel discussion was held which attempted to make an objective and pragmatic assessment of the standing of active control technology. The discussion focused on the standing of active control technology relative to civil air transport applications, the value as opposed to the cost of the projected benefits, the need for research, development, and demonstration, the role of government and industry in developing the technology, the major obstacles to its implementation, and the probable timing of the full utilization of active control technology in commercial transportation. An edited transcription of the prepared statements of the panel members and the subsequent open discussion between the panel and the audience is presented. Author

N76-31170* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCES USING WIND-TUNNEL MODELS IN ACTIVE CONTROL STUDIES c09
Robert V. Doggett, Jr., Irving Abel, and Charles L. Ruhlin *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 831-892 refs (For availability see N76-31135 22-01)
CSCL 14B

A status report and review of wind tunnel model experimental techniques that have been developed to study and validate the use of active control technology for the minimization of aeroelastic response are presented. Modeling techniques, test procedures, and data analysis methods used in three model studies are described. The studies include flutter mode suppression on a delta-wing model, flutter mode suppression and ride quality control on a 1/30-size model of the B-52 CCV airplane, and an active lift distribution control system on a 1/22 size C-5A model. Author

N76-31171* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF METHODS FOR THE ANALYSIS AND EVALUATION OF CCV AIRCRAFT c05
Robert C. Schwanz *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 895-921 refs (For availability see N76-31135 22-01)
CSCL 01C

The development of an advanced, computerized method for the analysis and evaluation of the aeroelastic stability and control parameters of controls fixed and controls free flight vehicles is presented. Specifically, the Level 2.01 FLEXSTAB computer program system is described. Technical areas in aerodynamics, dynamics, and control system synthesis are defined in which further research and development are planned to extend the analysis capability of the system for future CCV applications. Author

N76-31172* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHODOLOGY FOR DESIGN OF ACTIVE CONTROLS FOR V/STOL AIRCRAFT **c08**
George Meyer and Luigi Cicolani *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 923-931 (For availability see N76-31135 22-01)
CSCL 01C

An effort to develop techniques for the design of integrated, fully automatic flight control systems for powered lift STOL and VTOL aircraft is described. The structure is discussed of the control system which has been developed to deal with the strong nonlinearities inherent in this class of aircraft, to admit automatic coupling with the advanced ATC requiring accurate execution of complex trajectories, and to admit a variety of active control tasks. The specific case considered is the Augmentor Wing Research Aircraft. Author

N76-31173* Honeywell, Inc., Minneapolis, Minn.
ACTIVE CONTROL SYSTEM TRENDS **c08**
Eugene E. Yore and Dale C. Gunderson *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 933-944 refs (For availability see N76-31135 22-01)
CSCL 01C

The active control concepts which achieve the benefit of improved mission performance and lower cost and generate system trends towards improved dynamic performance, more integration, and digital fly by wire mechanization are described. Analytical issues and implementation requirements and tools and approaches developed to address the analytical and implementation issues are briefly discussed. Author

N76-31174* Sperry Flight Systems, Phoenix, Ariz.
THE IMPLEMENTATION OF FAIL-OPERATIVE FUNCTIONS IN INTEGRATED DIGITAL AVIONICS SYSTEMS **c06**
Stephen S. OSoer *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 947-971 (For availability see N76-31135 22-01)
CSCL 01D

System architectures which incorporate fail operative flight guidance functions within a total integrated avionics complex are described. It is shown that the mixture of flight critical and nonflight critical functions within a common computer complex is an efficient solution to the integration of navigation, guidance, flight control, display, and flight management. Interfacing subsystems retain autonomous capability to avoid vulnerability to total avionics system shutdown as a result of only a few failures. Author

N76-31175* Stanford Research Inst., Menlo Park, Calif.
A FORWARD VIEW ON RELIABLE COMPUTERS FOR FLIGHT CONTROL **c08**
Jack Goldberg and John H. Wensley *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 973-988 refs (For availability see N76-31135 22-01)
(Contract NAS1-10920)
CSCL 01C

The requirements for fault-tolerant computers for flight control of commercial aircraft are examined; it is concluded that the reliability requirements far exceed those typically quoted for space missions. Examination of circuit technology and alternative computer architectures indicates that the desired reliability can be achieved with several different computer structures, though there are obvious advantages to those that are more economic, more reliable, and, very importantly, more certifiable as to fault tolerance. Progress in this field is expected to bring about better computer systems that are more rigorously designed and analyzed even though computational requirements are expected to increase significantly. Author

N76-31176* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE EFFECTS OF LIGHTNING ON DIGITAL FLIGHT CONTROL SYSTEMS **c08**
J. Anderson Plumer (GE Co.), Wilbert A. Malloy (General Motors Corp.), and James B. Craft *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 989-1008 refs (For availability see N76-31135 22-01)
CSCL 01C

Present practices in lightning protection of aircraft deal primarily with the direct effects of lightning, such as structural damage and ignition of fuel vapors. There is increasing evidence of troublesome electromagnetic effects, however, in aircraft employing solid-state microelectronics in critical navigation, instrumentation and control functions. The potential impact of these indirect effects on critical systems such as digital fly by wire (DFBW) flight controls was studied. The results indicate a need for positive steps to be taken during the design of future fly by wire systems to minimize the possibility of hazardous effects from lightning. Author

N76-31177* Boeing Commercial Airplane Co., Seattle, Wash.
REDUNDANCY OF HYDRAULIC FLIGHT CONTROL ACTUATORS **c08**
C. C. Chenoweth and D. R. Ryder *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 1009-1018 refs (For availability see N76-31135 22-01)
CSCL 01C

The constraint of requiring airplanes to have inherent aerodynamic stability can be removed by using active control systems. The resulting airplane requires control system reliability approaching that of the basic airframe. Redundant control actuators can be used to achieve the required reliability, but create mechanization and operational problems. Of numerous candidate systems, two different approaches to solving the problems associated with redundant actuators which appear the most likely to be used in advanced airplane control systems are described. Author

N76-31178* Lockheed-Georgia Co., Marietta.
ACTIVE CONTROL TECHNOLOGY AND THE USE OF MULTIPLE CONTROL SURFACES **c08**
John E. Hart *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 1019-1025 (For availability see N76-31135 22-01)
CSCL 01C

Needed criteria for active control technology applications in commercial transports are lacking. Criteria for redundancy requirements, believed to be consistent with certification philosophy, are postulated to afford a discussion of the relative value of multiple control surfaces. The control power and frequency bandpass requirements of various active control technology applications are shown to be such that multiple control surfaces offer advantages in minimizing the hydraulic or auxiliary power for the control surface actuators. Author

N76-31179# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD HIGHLIGHTS, SEPTEMBER, 1976
Sep. 1976 21 p
(AGARD-Highlights-76/2) Avail: NTIS HC $3.50

Highlights of the 1976 AGARD meeting held in Paris, France are presented. Topics discussed were the following: the control configured vehicle concept; anti-flutter systems and anti-turbulence systems; direct force control surfaces; load reduction during maneuvers; aircraft safety; systems reliability; and stall/spin problems of military aircraft. B.B.

N76-31180# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1975-1
Dec. 1975 115 p refs Transl. into English of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 1-60 Original French report available from ONERA, Paris FF 30
(ESA-TT-232) Avail: NTIS HC $5.50

Publications appear on the following subjects: three dimensional boundary layers in a supersonic curved nozzle; unsteady forces caused by tail surfaces interactions; iterative method for structural dynamic characteristics; branch modes method for the dynamic characteristics of a helicopter; unsteady lift forces on a vibrating cylinder and compact laser velocimeter. For individual titles, see N76-31181 through N76-31186.

N76-31181 European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL ANALYSIS OF THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS IN A SUPERSONIC CURVED NOZZLE **c07**
Jean Cousteix, Roger Michel et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 1-10 (For availability see N76-31180 22-01)

The developing three dimensional turbulent boundary layer on the side wall of a curved nozzle in supersonic flow is studied for the design of the diffusers of supersonic centrifugal compressors. The taking of a large number of measurements of the mean velocity and of the direction of velocity within the boundary layer and the visualization of the surface flow constitute the experimental part of the study. A closely spaced network of pressure pick ups on the side wall provided the basis for the calculation of the external stream lines by integration of the Euler equation. Results were compared with those calculated by the method of characteristics. An integral prediction method was used to calculate the development of the boundary layer. Results obtained from this method were compared with experimental results. An attempt was made to channel the boundary layer flow by means of fences. Author (ESA)

N76-31182 European Space Agency, Paris (France).
A METHOD FOR CALCULATING THE UNSTEADY FORCES CAUSED BY THE INTERACTION BETWEEN TAIL SURFACES **c02**
Yoshio Akamatsu *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 21-36 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 11-20 (For availability see N76-31180 22-01)

A program is reported for the calculation of unsteady aerodynamic forces on a set of surfaces comprising a horizontal tail plane and a vertical fin by applying the potential method. The calculation method differs from conventional ones in that the normal velocity was obtained by numerical derivation of the potential calculated for the lifting surfaces and their immediate environs. It permits an appreciable simplification in programming and a saving of computer time. Comparison of results with those obtained by other methods shows good agreement.
Author (ESA)

N76-31183 European Space Agency, Paris (France).
AN ITERATIVE, SELF-ORGANISING METHOD FOR THE DETERMINATION OF STRUCTURAL DYNAMIC CHARACTERISTICS **c39**
Maurice Feix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 36-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 21-33 (For availability see N76-31180 22-01)

A method for determining the modal characteristics of a structure from harmonic vibration tests at several frequencies is presented. It was assumed that in regard to resonance only a small number of modes give an appreciable answer and that the structure behaves like a system with only a few degrees of freedom. Used are either applied forces or mass overloads. The method appears as iterative: starting from a force (or a mass) arbitrarily applied, progress is made by steps, each step providing indications for the execution of the next, while a test shows if the number of degrees of freedom to be considered is reached. Neither the number of degrees of freedom nor the location of excitation (or mass) points are fixed a priori, except for the first one. The practical interest of the method is illustrated by application to a theoretical and an actual structure. Author (ESA)

N76-31184 European Space Agency, Paris (France).
DETERMINATION OF THE DYNAMIC CHARACTERISTICS OF A HELICOPTER BY THE BRANCH-MODES METHOD **c08**
Henri Loiseau and Jacques-Roger Nicholas *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 61-81 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 35-44 (For availability see N76-31180 22-01)

Dynamic characteristics of a helicopter structure with a moving rotor are determined by using the branch modes method. The base, rotor head, and blades were from low damping homogenous materials with rigid or flexible connections having no dissipating hinge points. Test conditions were such that the unsteady aerodynamic forces on the blades were either zero or negligible. The mechanical properties of the model were linear and reproducible. The experiments allow an estimation of the precision required to obtain correct calculation results and show the validity limits of the method if applied to an actual helicopter. Author (ESA)

N76-31185 European Space Agency, Paris (France).
UNSTEADY LIFT FORCES ON A VIBRATING CYLINDER PLACED IN A SUPERCRITICAL FLOW **c02**
Edmond Szechenyi, Henri Loiseau et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 82-107 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 45-57 (For availability see N76-31180 22-01)

Lift measurements on a vibrating cylinder as part of a research program on unsteady pressures and lifting forces acting on a cylinder normal to a supercritical flow (high Reynolds number) are reported. Results already obtained on a clamped cylinder are recalled, and the vibrating model and the test methods are described. The conditions of autoexcitation were deduced. From these results it is possible to formulate a mathematical model permitting the calculation of the response amplitudes of a flexible cylinder subjected to a flow in the supercritical regime.
Author (ESA)

N76-31186 European Space Agency, Paris (France).
COMPACT LASER VELOCITY METER FOR MEASUREMENTS IN HIGHLY TURBULENT FLOWS **c35**
Alain Boutier and Jean Lefevre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 108-110 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 59-60 (For availability see N76-31180 22-01)

The selection of an optimum optical configuration is guided by the concentration of particles occurring in an aerodynamic flow. A beam divider was designed. Calculation of the distribution of the current strength within the volume being measured permitted the maximum sizes of this volume to be determined and changes in the dimensions as a function of the various parameters to be made. The signals were processed by spectral analysis. The velocity profiles in the supersonic mix zone (Mach 3) were constructed, as well as the corresponding turbulence profiles. Explorations of boundary layers under transonic flow conditions around a profile permitted both the capabilities and the limitations of the method to be determined.
Author (ESA)

N76-31187# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1973-6
Jul. 1976 84 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 311-354 Original French report available from ONERA, Paris FF 20
(ESA-TT-308) Avail: NTIS HC $5.00

Publications appear on the following subjects: linear filtering, simulation of rocket trajectory and satellite attitude restitution; internal noise in injector driven wind tunnels; numerical analysis of vortex sheets near the leading edge of a wing; three-dimensional flows in an axial turbomachine row; and use of branch modes for the calculation of helicopter structural dynamic characteristics. For individual titles, see N76-31188 through N76-31192.

N76-31188 European Space Agency, Paris (France).
LINEAR FILTERING: APPLICATION TO THE SIMULATION OF THE TRAJECTORY AND ATTITUDE RESTITUTION **c13**
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 311-319 Presented at the

Intern. Seminar on Simulation of Space, Toulouse, 10-14 Sep. 1973 (For availability see N76-31187 22-01)

Numerical simulation of linear filtering techniques as applied to rocket trajectory or satellite attitude restitution is discussed. Results of the theory of nonlinear filtering and those of the linear theory are recalled. Various difficulties encountered in the application of the linear theory are described briefly to bring out the usefulness of numerical simulation. The effectiveness of the simulation was illustrated with two examples: attitude restitution of rotating satellites (with an application to the ESA GEOS satellite) and restitution of the trajectory of rockets launched from the ground. ESA

N76-31189 European Space Agency, Paris (France).
EXPERIMENTAL STUDY OF THE INTERNAL NOISE IN INJECTOR DRIVEN WIND TUNNELS **c09**
Volker Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 21-30 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 321-324 Presented at 40th Supersonic Tunnel Assoc., Bedford, Engl., 24-26 Sep. 1973 (For availability see N76-31187 22-01)

The high level noise is studied that is emitted by the supersonic injector used as the driving element of an injector driven wind tunnel, notably the location of the injector in the circuit, its design, and its mode of operation in order to eliminate any adverse effect on the quality of the flow and, consequently, on the validity of the test results. Solutions are proposed, based on the experience acquired in a pilot wind tunnel which offers the possibility of a detailed study of the injector both from the point of view of its performance and the quality of the flow. The overall sound pressure level measured in the working section was approximately the same as that obtained for similar flow conditions when the injector driven system was replaced by a conventional downstream system with suction. Author (ESA)

N76-31190 European Space Agency, Paris (France).
NUMERICAL INVESTIGATION OF VORTEX SHEETS ISSUED ALONG A SEPARATION LINE NEAR THE LEADING EDGE OF A WING
Colmar Rehbach *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 31-42 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 325-330 Presented at the Euromech Colloq. 41 on Concentrated Vortices, Norwich, Engl., 18-21 Sep. 1973 (For availability see N76-31187 22-01)

The vortex sheets formed along the separation line near the leading edge of a slender delta wing were investigated. The theoretical treatment of this problem was possible for this simple form of wing and was carried out within the limits of such approximations as slender body theory and/or conical flow. Yet the phenomenon of building up vortex sheets on the leading edge of airfoils is encountered by more general geometric configurations, for which an analytic treatment is out of the question. For these configurations, an iterative method of calculation is suggested, based on the replacement of the vortex sheet representing the wing and its trailing sheet, by a system of concentrated line vortices. The presented results are limited to plane delta wings. The results are compared with those obtained by purely analytic methods and with the experiments performed with the ONERA water tunnel. Author (ESA)

N76-31191 European Space Agency, Paris (France).
ON THREE-DIMENSIONAL FLOWS CLOSE TO A HELICAL FLOW IN AN AXIAL TURBOMACHINE ROW **c02**
Radyadour K. Zeytounian *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 43-50 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 331-335 (For availability see N76-31187 22-01)

The problem of calculating the three-dimensional flow induced in a blade row (moving or stationary) in an axial turbomachine was reduced, within the framework of a linear theory, to the solution of a system of two linear equations for the two disturbance flow functions. One of these equations describes the pseudo-mean flow and the other the cascade flow, these two flows being connected by a fully explained mechanism. Author (ESA)

N76-31192 European Space Agency, Paris (France).
ON THE USE OF BRANCH MODES FOR THE CALCULATION OF HELICOPTER STRUCTURAL DYNAMIC CHARACTERISTICS **c39**
Cam Thuy Tran, William Twomey, and Rolland Dat *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 51-80 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 337-354 Sponsored by Soc. Natl. Ind. Aerospatiale (For availability see N76-31187 22-01)

The dynamic characteristics of the complete structure, including fuselage and rotor, are determined from the normal branch modes which characterize separately the fuselage and the blades. With an appropriate choice of coordinates, a set of second order linear differential equations with constant coefficients was obtained. The solutions define natural vibration modes which vary with the blade rotational speed. The results obtained on a helicopter model are in agreement with the experiments.
Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-31193# Aeronautical Research Council, London (England).
THE CHARACTERISTICS OF A FAMILY OF ROOFTOP AEROFOILS DESIGNED AT THEIR DRAG-RISE CONDITION IN VISCOUS, COMPRESSIBLE FLOW. PART 1: DESIGN CONDITION
B. G. J. Thompson and S. W. Cosby 1975 47 p refs Supersedes RAE-TR-72141-Pt-1; ARC 34-437
(CP-1320) Avail: NTIS HC $4.00; HMSO £1.80; PHI

Twenty-eight members of the original family of aerofoils, presented previously, were redesigned using an inverse method which takes account of the major influence of the boundary layer and wake on the pressure distribution. The more accurate compressibility law devised by Wilby and Lock is used. Hodges' results suggesting that the published family has an overoptimistic performance are confirmed. The new sections have design lift coefficients which are usually lower than the original values by amounts up to 10%. Their drag coefficients are higher by 0.0001 to 0.0004 but they have a wider range of attached flow in conditions of practical interest, according to Stratford's method, because of more realistic trailing edge pressures. The drag values, separation boundaries and drag-rise boundaries are presented together with tabulation of ordinates and design pressure distributions for the complete series of redesigned aerofoils. The 50% rooftop sections as typical examples, and the basis upon which the new designs were obtained are presented. Author

N76-31194*# Scientific Translation Service, Santa Barbara, Calif.
PRESSURE DISTRIBUTION OVER SYMMETRIC WING PROFILES FOR TRANSONIC FLOW
J. C. Rotta and K. Oswatitsch Washington NASA Aug. 1976 23 p refs Transl. into ENGLISH from the book "Symposium Transsonicum" Berlin, Springer Verlag, 1964 p 137-151
(Contract NASw-2791)
(NASA-TT-F-17201) Avail: NTIS HC $3.50 CSCL 01A

Pressure distribution measurements for flows close to the speed of sound in a free jet wind tunnel come very close to those in free flow. In the calculation method for the pressure distribution of two dimensional flow over wing profiles it is important that the distribution ahead and behind the shock are determined independently. The position of the shock is determined by satisfying pressure change over the shock and the Betz resistance condition. Author

N76-31195*# Lockheed Aircraft Corp., Burbank, Calif.
FEASIBILITY STUDY OF INLET SHOCK STABILITY SYSTEM OF YF-12
G. C. Blausey, D. M. Coleman, and D. S. Harp 17 Nov. 1972 145 p refs

(NASA-CR-134594; Sp-1964) Avail: NTIS HC $6.00 CSCL 01A

The feasibility of self actuating bleed valves as a shock stabilization system in the inlet of the YF-12 is considered for vortex valves, slide valves, and poppet valves. Analytical estimation of valve performance indicates that only the slide and poppet valves located in the inlet cowl can meet the desired steady state stabilizing flows, and of the two the poppet valve is substantially faster in response to dynamic disturbances. The poppet valve is, therefore, selected as the best shock stability system for the YF-12 inlet. Author

N76-31196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISON OF THEORETICAL AND EXPERIMENTAL STEADY WING LOADS ON A SPACE SHUTTLE CONFIGURATION AT MACH NUMBERS OF 0.6 AND 1.4

John S. Preisser and Harold E. Lowder, Jr. Washington Sep. 1976 58 p refs

(NASA-TM-X-3404; L-10794) Avail: NTIS HC $4.50 CSCL 01A

A computer program is described that was used to theoretically calculate aerodynamic loads for the space shuttles wings. Various finite-element panel schemes and the interference effects of orbiter fuselage, external tank, and solid rocket motors were studied. The Results indicate that the choice of wing panel scheme made little difference on the calculated wing pressures, whereas interference effects resulted in reduction in normal-force coefficient across the entire wingspan. In general, the theoretical results compared reasonably well with the experimental data, except in the multiple-body supersonic regime where numerical convergence problems were encountered. Photographs of scale models that underwent wind tunnel tests in the experimental portion of the work are shown. Author

N76-31197*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

VELOCITY SURVEYS IN A TURBINE STATOR ANNULAR-CASCADE FACILITY USING LASER DOPPLER TECHNIQUES

Louis J. Goldman, Richard G. Seasholtz, and Kerry L. McLallin Washington Sep. 1976 27 p refs

(NASA-TN-D-8269; E-8637) Avail: NTIS HC $4.00 CSCL 01A

A laser Doppler velocimeter (LDV) was used to determine the flow conditions downstream of an annular cascade of stator blades operating at an exit critical velocity ratio of 0.87. Two modes of LDV operation (continuous scan and discrete point) were investigated. Conventional pressure probe measurements were also made for comparison with the LDV results. Biasing errors that occur in the LDV measurement of velocity components were also studied. In addition, the effect of pressure probe blockage on the flow conditions was determined with the LDV. Photographs and descriptions of the test equipment used are given. Author

N76-31198*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF SIMULATED FORWARD AIRSPEED ON SMALL-SCALE-MODEL EXTERNALLY BLOWN FLAP NOISE

Jack H. Goodykoontz, Robert G. Dorsch, and William A. Olsen Washington Sep. 1976 58 p refs

(NASA-TN-D-8305; E-8697) Avail: NTIS HC $4.50 CSCL 01A

Noise tests were conducted on a small-scale model of an externally blown flap lift augmentation system. The nozzle/wing model was subjected to external flow that simulated takeoff and landing flight velocities by placing it in a 33-centimeter-diameter free jet. The results showed that external flow attenuated the noise associated with the various configurations tested. The amount of attenuation depended on flap setting. More attenuation occurred with a trailing-flap setting of 20 deg than with one of 60 deg. Noise varied with relative velocity as a function of the trailing-flap setting and the angle from the nozzle inlet. Author

N76-31199*# Virginia Univ., Charlottesville. Dept. of Engineering Science.

SURFACE PRESSURE MEASUREMENTS ON A SERIES OF TWO-DIMENSIONAL YAWMETER BODIES

Michael J. Goodyer Washington NASA Aug. 1976 21 p refs

(Grant NsG-1010)

(NASA-CR-2736) Avail: NTIS HC $3.50 CSCL 01A

It is shown that certain two dimensional bodies exist having a sensitivity of surface pressure to flow direction which is much higher than for currently used two dimensional yawmeters. A body having a simple cross sectional shape was selected for experimental evaluation at low Mach number, but at a typical Reynolds number for such instruments. Author

N76-31200*# Colorado Univ., Boulder.

HYPERSONIC FLIGHT MECHANICS Final Technical Report, 1 Jun. 1974 - 1 Sep. 1976

Adolph Busemann, Nguyen X. Vinh, and Robert D. Culp 1 Sep. 1976 433 p refs

(Grant NsG-1056)

Avail: NTIS HC $11.75 CSCL 01A

The effects of aerodynamic forces on trajectories at orbital speeds are discussed in terms of atmospheric models. The assumptions for the model are spherical symmetry, nonrotating, and an exponential atmosphere. The equations of flight, and the performance in extra-atmospheric flight are discussed along with the return to the atmosphere, and the entry. Solutions of the exact equations using directly matched asymptotic expansions are presented. F.O.S.

N76-31201# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

RIBBON AND GLIDING TYPE PARACHUTES EVALUATED IN THE 7 BY 10 FOOT TRANSONIC WIND TUNNEL

J. Ottensoser Sep. 1975 194 p

(Contract AT(29-1)-789)

(SAND-75-7072) Avail: NTIS HC $7.50

An experiment was conducted in the NSRDC 7- x 10-foot transonic tunnel to evaluate various parachute parameters. The experiment consisted of three main parts: the first phase evaluated the disreefing characteristics of the various parachutes as well as the drag forces before, during, and after disreefing; the second phase measured the pressure distribution around the chute as well as the drag forces; and the final phase evaluated the disreefing and drag characteristics of gliding type parachutes. The free stream dynamic pressure varied from 65 to 500 psf. Author (ERA)

N76-31202# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

EDUCATION AND RESEARCH, 1956 - 1976

1975 118 p refs

Avail: NTIS HC $5.50

The scope, relationship with other organizations, educational programs, and research activities of the Von Karman Institute for Fluid Dynamics are presented. Work is detailed of the main departments, such as the Aeronautics/Aerospace Department (low and high speed aeronautics, reentry flow studies, rarefied gas dynamics), the Turbomachinery Department (axial and radial compressors, pumps, turbines, computational methods for turbomachinery), the General and Environmental Fluid Dynamics Department (heat and mass transfer, mechanics of turbulence, wind effects on buildings and structures, etc), and the Computational Fluid Dynamics Department (inviscid flows, viscous flows and heat transfer). The instrumentation developments are also included. The main technical facilities which are presently available at the Institute as well as the necessary technical support are briefly described. ESA

N76-31203# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

EFFECT OF SPECIFIC CONFIGURATION CHANGES ON THE AERODYNAMICS OF THE MSC-040-A ORBITER AT TRANSONIC SPEEDS

Egon Stanewsky and Gaston Netter (ERNO Raumfahrttech. GmbH) 9 Jan. 1975 110 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(Contract GfW-RV-11-TP-16/72-B)

(DLR-FB-75-18) Avail: NTIS HC $5.50; DFVLR, Porz, West

Ger. DM 51,60

The effect of specific configuration changes on the longitudinal and lateral-directional characteristics of the MSC-040-A Space Shuttle Orbiter was investigated. Essential configuration changes included the design of the vertical tail, a wider forward fuselage, and the aerodynamic shaping of the wing ACPS pods. Results of this investigation are summarized. In addition, the effect of Reynolds number and transition on the flow development on the Orbiter is demonstrated. Author (ESA)

N76-31204# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Theoretische Gasdynamik.

REPRESENTATION AND CALCULATION OF FLOW PAST WINGS IN STEADY SUPERSONIC FLIGHT, BASED ON LIFT-UPWASH RELATIONS

Erich Leiter (Tech. Hochschule, Vienna) 26 Aug. 1975 127 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-75-61) Avail: NTIS HC $6.00; DFVLR, Cologne DM 57,50

A linearized wing theory was derived from a general relation between lift- and down/upwash-distribution. This equation was obtained as a solution of an initial value problem of Hadamards integration theory. The known results were deduced. Analytical approximations are given for the upwash-distribution. In case of wings with two subsonic leading edges successive approximations and estimations of errors are made available. A new subsonic-supersonic analogy is pointed out. Author (ESA)

N76-31205# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE PREDICTION OF HELICOPTER ROTOR HOVER PERFORMANCE USING A PRESCRIBED WAKE ANALYSIS

C. Young London Aeron. Res. Council 1976 52 p refs Supersedes RAE-TR-74078; ARC-35652

(ARC-CP-1341; RAE-TR-74078; ARC-35652) Avail: NTIS HC $4.50; HMSO £2.00; PHI

A method of calculating the performance of a helicopter rotor in the hover is presented. The method combines the downwash velocity distribution induced by a contracting spiral vortex wake with strip element-momentum theory. The shape of the wake takes a prescribed geometry developed from an extensive series of model tests made in the U.S. The predicted thrust and power is in good agreement with measurements made on model and full scale rotors provided that the airfoil data is sufficiently well defined. The calculated load distribution along the blade is also compared with measurements made on Wessex helicopters. The load distribution is shown to be very sensitive to a light wind but theory compares well with experiment when this effect is eliminated. The hover performance predicted using only the wake induced velocity distribution is also discussed. The rotor performance is shown to be too sensitive to the geometry of the wake for the method to be used as a design tool with confidence, and the mathematical representation of the wake needs improving. Author (ESA)

N76-31206# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE COMPUTATION OF TWO DIMENSIONAL SUPERSONIC FLOWS IN LAVAL TYPE NOZZLES

A. Hillman and H. J. Wirz Feb. 1976 41 p refs

(VKI-TN-116) Avail: NTIS HC $4.00

A computer program was developed to solve the steady two-dimensional inviscid Euler equations for supersonic flows in Laval type nozzles using a finite difference method, and axisymmetric potential flows examined in nozzles of various throat curvatures. The finite difference method has demonstrated the concept of the optimum nozzle and may be extended to three dimensions to treat axisymmetric nozzle geometries. The range of Laval nozzle shapes to which the method may be applied is only limited by the accuracy by which starting conditions for the integration procedure may be specified. ESA

N76-31207# European Space Agency, Paris (France).

UNSTEADY PRESSURES ON A HARMONICALLY OSCILLATING, STAGGERED CASCADE. PART 1: INCOMPRESSIBLE FLOW

Hermann Triebstein, V. Carstens, and J. Wagner Mar. 1976 70 p refs Transl. into ENGLISH of "Instationaere Druckverteilungen an einem harmonisch schwingenden, gestaffelten Schaufelgitter. Teil 1: Ergeb. fuer inkompressible Stroemung"; DFVLR, Goettingen, West Ger. Report DLR-FB-75-57, 1 Sep. 1975 Original German report available from DFVLR, Cologne DM 32,70 2 Vol.

(ESA-TT-272-Pt-1; DLR-FB-75-57-Pt-1) Avail: NTIS HC $4.50

The measurement of unsteady airloads on harmonically oscillating cascade airfoils in an incompressible flow is dealt with. Special emphasis is given the cascade wind tunnel of the DFVLR-AVA at Goettingen on a plate-like staggered cascade consisting of seven plates at harmonically pitching oscillations around two different pitching axes, and at flapping oscillations of both the whole cascade and one flat plate only. The measurements were performed at an angle of attack 0, a stagger angle 60 deg, and a Mach number 0.2; the oscillation frequencies were 10, 30, and 70 cps, thus yielding reduced frequencies 0.04 to 0.26 and a Reynolds number 340,000. Some of the test results were compared with corresponding theoretical results. Author (ESA)

N76-31208# European Space Agency, Paris (France).

UNSTEADY PRESSURES ON A HARMONICALLY OSCILLATING, STAGGERED CASCADE. PART 2: COMPRESSIBLE FLOW

Hermann Triebstein, V. Carstens, and J. Wagener Mar. 1976 89 p refs Transl. into ENGLISH of "Instationaere Druckverteilungen an einem harmonisch schwingenden, gestaffelten Schaufelgitter. Teil 2: Ergeb. fuer kompressible Stroemung"; DFVLR, Goettingen, West Ger. Report DLR-FB-75-58, 30 Jul. 1975 Original German report avaiiable from DFVLR, Cologne DM 41,60 2 Vol.

(ESA-TT-273-Pt-2; DLR-FB-75-58-Pt-2) Avail: NTIS HC $5.00

For abstract, see Vol. 1.

N76-31182 European Space Agency, Paris (France).

A METHOD FOR CALCULATING THE UNSTEADY FORCES CAUSED BY THE INTERACTION BETWEEN TAIL SURFACES

Yoshio Akamatsu *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 21-36 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 11-20 (For availability see N76-31180 22-01)

N76-31185 European Space Agency, Paris (France).

UNSTEADY LIFT FORCES ON A VIBRATING CYLINDER PLACED IN A SUPERCRITICAL FLOW

Edmond Szechenyi, Henri Loiseau et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 82-107 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 45-57 (For availability see N76-31180 22-01)

N76-31191 European Space Agency, Paris (France).

ON THREE-DIMENSIONAL FLOWS CLOSE TO A HELICAL FLOW IN AN AXIAL TURBOMACHINE ROW

Radyadour K. Zeytounian *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 43-50 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 331-335 (For availability see N76-31187 22-01)

N76-32106 European Space Agency, Paris (France).

UNSTEADY FLOW MEASUREMENTS IN TURBOMACHINES

Robert Larguier and Alexandre DeSievers *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 61-86 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 267-277 (For availability see N76-32103 22-99)

N76-32109 European Space Agency, Paris (France).

MATHEMATICAL MODEL OF THE VIBRATION INDUCED BY VORTEX SHEDDING

Edmond Szechenyi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 138-168 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 301-312 (For availability see N76-32103 22-99)

N76-32112 European Space Agency, Paris (France).
NUMERICAL CALCULATION OF THE TRANSONIC FLOW OF IDEAL FLUID THROUGH CASCADES
Jean-Pierre Veuillot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 30-52 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 327-338 (For availability see N76-32110 22-99)

N76-32113 European Space Agency, Paris (France).
A FULLY CONSERVATIVE RELAXATION METHOD FOR TRANSONIC FLOW
Jean-Jacques Chattot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 53-68 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 339-346 (For availability see N76-32110 22-99)

N76-32118 European Space Agency, Paris (France).
BEHAVIOUR OF A TURBULENT NEAR-WAKE FLOW AT SUPERSONIC SPEED
Jean-Paul Dussauge and Jean Gaviglio *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 40-61 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 145-154 (For availability see N76-32116 22-99)

N76-32122 European Space Agency, Paris (France).
INTRODUCTION OF UNSTEADY SEPARATION INTO ACCELERATION POTENTIAL THEORY. APPLICATION TO HELICOPTERS
Jean-Joel Costes *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 107-145 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 175-188 (For availability see N76-32116 22-99)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-31209# New York City Transporation Administation, N. Y. Office of the Administrator.
THE OPERATION OF HOVERCRAFT IN THE NEW YORK CITY METROPOLITAN AREA. VOLUME 1: A TECHNICAL EVALUATION Final Report, 2-4 Oct. 1973
Feb. 1975 79 p refs
(Contract DOT-PS-40282)
(PB-251234/1; DOT-TST-75-86-Vol-1) Avail: NTIS HC $5.00 CSCL 13B

The technical feasibility of using air cushion vehicles (ACV) in the inland waterways of the New York City metropolitan area was evaluated. This evaluation was based on 1973 tests with a Wellington Class BH.7 hovercraft along routes representing the main corridors of activity of the New York City regional waterways. The hovercraft was a military configuration without weapons, heavily instrumented for trial and testing for military purposes, and not intended for use as a commercial vehicle. During the 3-day trials, data were collected on speed, docking procedures, fueling requirements, airport access, operating noise levels, and operational flexibility. Observations were made of performance, comfort and convenience. GRA

N76-31210# Dayton Univ. Research Inst., Ohio.
CHARACTERIZATION OF BIRD IMPACTS ON A RIGID PLATE, PART 1 Technical Report, 1 Jan. - 30 Nov. 1974
John P. Barber, Henry R. Taylor, and James S. Wilbeck (AFML, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFFDL Jan. 1975 101 p
(Contract F33615-73-C-5027; AF Proj. 7351)
(AD-A021142; AFFDL-TR-75-5-Pt-1) Avail: NTIS CSCL 01/2

Aircraft may be damaged or even destroyed by inflight impacts with birds. Windshields and jet engine fan blades are particularly vulnerable to damage by bird impacts. The purpose of this study has been to experimentally determine the pressure-time variations generated by small birds impacting a flat rigid plate, in an effort to characterize the loading of real aircraft components by bird impacts. GRA

N76-31211# Goodyear Aerospace Corp., Litchfield Park, Ariz.
BIRD STRIKE CAPABILITIES OF TRANSPARENT AIRCRAFT WINDSHIELD MATERIALS. PART 2: SUPPLEMENTAL EVALUATION OF PARAMETERS AFFECTING MATERIALS RESPONSE Final Report, 15 Jan. - 17 Jul. 1975
A. O. Ingelse, G. E. Wintermute, M. H. Gaynes, and Ell. Waters Oct. 1975 113 p
(Contract F33615-72-C-1896; AF Proj. 7381)
(AD-A021122; GERA-2107-Pt-2; AFML-TR-74-234-Pt-2) Avail: NTIS CSCL 01/2

This is the final technical report on an expanded scope test program to obtain additional engineering data on the bird strike capabilities of selected transparent materials and composites. The test program used polycarbonate materials exclusively as the structural member, except in test series 5., alternate configuration, where three windshields of stretched acrylic were tested. Polycarbonates in thicknesses from 0.25 to 1.00 inch in as-extruded, press-polished and fusion-bonded conditions were tested as well as three different interlayer materials to specifically meet the required parameters of the seven test series. Test velocities ranged from 217 to 643 knots. As a result of this program, a considerable amount of additional data has been recorded to improve and extend the original data plots from AFML-TR-74-234. GRA

N76-31164* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED CONTROL TECHNOLOGY AND AIRWORTHINESS FLYING QUALITIES REQUIREMENTS
C. Thomas Snyder *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 707-733 refs (For availability see N76-31135 22-01)
CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N76-31212# Hazeltine Corp., Greenlawn, N.Y.
ATCRBS ANTENNA MODIFICATION KIT Final Report, Aug. 1973 - Mar. 1974
E. M. Newman and P. Kendrick Jun. 1976 183 p
(Contract DOT-TSC-598)
(AD-A026392/1; DOT-TSC-FAA-75-6; FAA-RD-75-40) Avail: NTIS HC $7.50 CSCL 17/7

The design, fabrication and test results are described for an improved Air Traffic Control Radar Beacon System array antenna for mounting on the reflector of an ASR radar antenna. The antenna consists of a 4-foot high by 26-foot wide array with 252 dipole radiating elements. The structure of the antenna utilizes a specially designed tuned reflector to provide a physically open ground plane which minimizes wind loading while maintaining low backlobe levels. A companion 4-foot high omni antenna,

intended for mounting on a pole next to the array, was fabricated and tested, and is also described. Tabulated data of antenna radiation patterns are included. Author

N76-31213# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TESTS WITH WILCOX SLOTTED-CYLINDER VOR ANTENNA Final Report, Jan.-Jul. 1975
Wayne E. Bell and Edward N. Lind Apr. 1976 42 p
(AD-A026391/3; FAA-NA-75-68; FAA-RD-76-30) Avail: NTIS HC $4.00 CSCL 17/7

An improved Wilcox slotted-cylinder VOR antenna was evaluated when configured for VOR, VOR/DME, and VORTAC operations. Airborne and ground measurements which included bearing error, vertical polarization, and cone of confusion tests determined that the antenna meets Federal Aviation Administration operating tolerances. Author

N76-31214*# Sperry Flight Systems, Phoenix, Ariz.
A TECHNIQUE FOR GENERATING ARBITRARILY SHAPED CURVED APPROACH PATHS Final Report
Walter J. McConnell, Jr. Washington NASA Aug. 1976 60 p refs
(Contract NAS1-12365)
(NASA-CR-2734; Rept-71-0839-00-00) Avail: NTIS HC $4.50 CSCL 17G

A technique for creating and using arbitrarily curved flight paths is described, in conjunction with either automatic or manual guidance. Operating techniques for VTOL aircraft in the terminal area environment are investigated. Straight lines and elliptical segments to connect a series of data points into a continous approach path were developed. Software was created to allow the generation of arbitrarily shaped altitude and speed profiles in conjunction with the lateral curved paths. Author

N76-31215*# Crumrine (Ralph J.), Olathe, Kans.
FLIGHT SIMULATION STUDY TO DETERMINE MLS LATERAL COURSE WIDTH REQUIREMENTS ON FINAL APPROACH FOR GENERAL AVIATION
Ralph J. Crumrine Jul. 1976 35 p refs
(NASA Order A-15538-B)
(NASA-CR-137859) Avail: NTIS HC $4.00 CSCL 17G

An investigation of the effects of various lateral course widths and runway lengths for manual CAT I Microwave Landing System instrument approaches was carried out with instrument rated pilots in a General Aviation simulator. Data are presented on the lateral dispersion at the touchdown zone, and the middle and outer markers, for approaches to 3,000, 8,000 (and trial 12,000 foot) runway lengths with full scale angular lateral course widths of + or - 1.19 deg, + or - 2.35 deg, and + or - 3.63 deg. The distance from touchdown where the localizer deviation went to full scale was also recorded. Pilot acceptance was measured according to the Cooper-Harper rating system. Author

N76-31216# National Aerospace Lab., Amsterdam (Netherlands). Div. Flight.
DESCRIPTION OF A SMOOTHING TECHNIQUE WITH SLOPE-CONTINUOUS PIECEWISE CUBIC POLYNOMIALS AND ITS APPLICATION TO RADAR POSITION MEASUREMENTS
J. J. Renes 23 May 1975 18 p refs
(NLR-TR-74023-U) Avail: NTIS HC $3.50

A method is derived to calculate the least squares approximation to a multidimensional time series using slope-continuous piecewise cubic polynomials. Its application to the smoothing of radar position measurements is described and the resulting position and speed curves are displayed for two types of radar measuring devices, namely, the secondary surveillance radar and the lock follow radar. It is concluded that the analytical representation of the curve is simple, provides a significant data reduction, and can be used in further calculations, and, consequently, is suitable for the processing and storage of large quantities of three dimensional radar measured aircraft flight paths. Author (ESA)

N76-31156* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FLIGHT INVESTIGATION OF A TERMINAL AREA NAVIGATION AND GUIDANCE CONCEPT FOR STOL AIRCRAFT
D. W. Smith, F. Neuman, D. M. Watson, and G. H. Hardy *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 17G

N76-31157* Boeing Commercial Airplane Co., Seattle, Wash.
SOME SYSTEM CONSIDERATIONS IN CONFIGURING A DIGITAL FLIGHT CONTROL - NAVIGATION SYSTEM
J. H. Boone and G. R. Flynn *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-31217*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF A VERY LARGE CATAMARAN FREIGHTER AS A DERIVATIVE OF A CURRENT WIDE-BODY AIRCRAFT
Harry H. Heyson 18 Aug. 1976 24 p refs
(NASA-TM-X-73940) Avail: NTIS HC $3.50 CSCL 01C

The development of a very large cargo aircraft by combining, in catamaran fashion, two existing wide body transports was studied. Advantages of this system include: lighter weight and increased payload; increased fuel economy; and reduction in direct operating costs. Author

N76-31218# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
COMMENTS ON THE NOTION OF LOFT CEILING
J. Shinar, J. Levin, and A. Marari May 1976 15 p refs
(TAE-283) Avail: NTIS HC $3.50

The loft ceiling is defined as the highest altitude permitting vertical equilibrium in level flight. This notion is briefly discussed. Author

N76-31219*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC TRANSPORT Patent Application
Paul L. Coe, Jr., inventor (to NASA) Filed 27 Aug. 1976 16 p
(NASA-Case-LAR-11932-1; US-Patent-Appl-SN-718244) Avail: NTIS HC $3.50 CSCL 01C

Ideas were proposed to improve the design of supersonic transport aircraft. These include thrust vectoring in conjunction with wing apex segments used as canard surfaces during take-off, landing, and low-speed flight. The angle of incidence of the wing apex segments, when the segments are functioning as canard surfaces, is variable with respect to the aircraft angle of attack. The wing apex segments furthermore form a portion of the main wing panel swept leading edge when not functioning as canard surfaces. The combination of thrust vectoring and deployable wing apex segments results in increased aircraft range and improved low-speed longitudinal stability while providing acceptable take-off length capabilities. NASA

N76-31220# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge.
AIRCRAFT COMPARISON DATA. EXTRACT FROM AERONAUTICAL HANDBOOK, VOLUME TYPE COMPARISON [FLUGZEUG-VERGLEICHSUNTERLAGEN. AUSZUG AUS LUFTFAHRTTECHNISCHEM HANDBUCH, BAND TYPENVERGLEICH]
D. Fiecke Bonn DOKZENTBw 1975 104 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVg-FBWT-75-20) Avail: NTIS HC $5.50; DOKZENTBw DM 30

An extract from the Aeronautical Handbook is presented, presenting data for the F-100 aircraft and some statistical and analytical correlations. These correlations show geometrical, aerodynamic, weight, propulsion, and performance data as a function of technical parameters, useful for comparison purposes. Author (ESA)

N76-31221# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

THE DEVELOPMENT OF TRANSONIC AIRFOILS FOR HELICOPTERS

J. W. Slooff, F. X. Wortmann (Stuttgart Univ.), and J. M. Duhon (Bell Helicopter Co.) May 1975 15 p refs Presented at the 31st Ann. Natl. Forum of the Am. Helicopter Soc., Washington, May 1975

(NLR-MP-75032-U) Avail: NTIS HC $3.50

Two approaches to the design of helicopter main rotor blade airfoils are presented which attempt to satisfy specific design criteria in the transonic regime. The successful design of such airfoils results in significant performance improvements. Examples of power required savings are discussed. One of the two design approaches is a simplified three-step method to achieving shockless flow for the low lift, high Mach number and the high lift, moderate Mach number conditions. The second method, developed at the Netherlands National Aerospace Laboratory (NLR) aims at the same objectives by use of a transonic hodograph method. Airfoils designed by the two methods are described, and their qualities are discussed. Performance of a helicopter using such airfoils is analytically determined and compared with more conventional designs. Author (ESA)

N76-31222# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

AN EXPERIMENTAL STUDY ABOUT THE EFFECT OF THRESHOLDS ON G ACCELERATION COUNTINGS OBTAINED FROM A MILITARY AIRPLANE

O. Buxbaum and V. Ladda Sep. 1975 27 p refs Sponsored by Min. of Defence

(LBF-TB-123/75) Avail: NTIS HC $4.00

Constant g vertical accelerations of a military airplane which have been recorded continuously on magnetic tape during flight operation in two types of missions were analyzed statistically by means of a digital computer, in which the different counting procedures of acceleration counting systems (fatigue meters) as used by various countries for fatigue life monitoring of aircraft were simulated. The results are presented in form of cumulative frequency distributions and have been critically valued.

Author (ESA)

N76-31223# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Entwurfsaerodynamik.

GENERAL SURVEY OF COMPUTER-METHODS USED FOR AERODYNAMIC DESIGN IN THE FEDERAL REPUBLIC OF GERMANY

H. Koerner 15 Sep. 1975 64 p refs Presented at the Fluid Dyn. Panel Meeting, London, 9 Oct. 1975

(DLR-IB-151-75/13) Avail: NTIS HC $4.50

The survey contains methods for transonic flow on airfoils, wings, and wing-fuselage combinations, for aerodynamic interference in sub- and supersonic flow and for viscous interactions. The methods are mainly network, integral equation, and hodograph methods. In addition to the description some examples are given which show the applicability of the methods. Some test cases for computer methods are proposed.

Author (ESA)

N76-31224# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

A STUDY OF THERMAL FATIGUE ACCELERATION IN BOX BEAMS UNDER MECHANICAL AND THERMAL STRESS

F. E. Kiddle, R. J. Kite, and R. F. Mousley London Aeron. Res. Council 1976 69 p refs Supersedes RAE-TR-75039; ARC-36487

(ARC-CP-1342; RAE-TR-75039; ARC-36487) Avail: NTIS HC $4.50; HMSO £2.30; PHI

In the full-scale fatigue testing of the Concorde there is a need to accumulate damage at a higher rate than in service in order to meet certification requirements. One contribution to the more rapid testing of the Concorde comes from accelerating the rate of thermal fatigue damage by increasing the range of temperatures applied to the aircraft and hence increasing the associated thermal stress in each thermal cycle. Tests in which thermal stresses were generated in a representative structural specimen and were adjusted to give a designed acceleration factor of 2 are described. It is shown that this method of accelerating thermal damage was resonably accurate. Further work is discussed which will investigate the acceleration of thermal fatigue damage under conditions more representative of Concorde in service and in the full-scale fatigue test, particularly in representing times at temperature. Author (ESA)

N76-31225# Saint Louis Univ., Cahokia, Ill.

UH-1H FLAT RATE MANUAL, VOLUME 2 Final Report, 1 Apr. 1971 - 31 Dec. 1973

Al Holfeldt and Bernie Perant Jul. 1975 191 p

(Contract DAAJ01-72-A-0027)

(AD-A020730; USAAVSCOM-TR-76-4) Avail: NTIS CSCL 01C

The purpose of this Flat Rate Manual is to provide stastical man-hour parameters for the performance of tasks involved at the Organizational, Direct, and General maintenance levels for the UH-1H aircraft. It is intended for evaluating and predicting maintenance requirements and/or comparing the performance of an activity against a recognized standard. Author (GRA)

N76-31226# Saint Louis Univ., Cahokia, Ill.

UH-1H FLAT RATE MANUAL, VOLUME 1 Final Report, 1 Apr. 1971 - 31 Dec. 1973

Al Holfeldt and Bernie Perant Jul. 1975 280 p

(Contract DAAJ01-72-A-0027)

(AD-A020729; USAAVSCOM-TR-76-3) Avail: NTIS CSCL 01C

For abstract, see preceding accession.

N76-31227# Naval Ship Research and Development Center, Bethesda, Md.

A TECHNICAL SUMMARY OF AIR CUSHION CRAFT DEVELOPMENT

Peter J. Mantle Oct. 1975 369 p refs

(AD-A022583; DTNSRDC-4727) Avail: NTIS CSCL 13/10

A brief review is given of the technical status of the state-of-the-art in air cushion craft as it exists today. The designation 'air cushion craft' is all encompassing, in that it covers all craft operating close to the surface and relying on a cushion of air to generate significant portions of their lift. It includes both the amphibious craft known as air cushion vehicles (ACV) or hovercraft and the nonamphibious craft known as surface effect ships (SES). Where applicable, the technology of other special uses of the air cushion is called upon to illustrate a point. GRA

N76-31228# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

A COMPUTER PROGRAM TO AUTOMATE A METHOD FOR PREDICTING ACOUSTICALLY INDUCED VIBRATION IN TRANSPORT AIRCRAFT

Terry Harris Jan. 1976 53 p refs

(AD-A022571; AFFDL-TM-75-111-FYS) Avail: NTIS CSCL 01/3

The report presents a computer program which automates a vibration prediction method. Inputs to the program are estimates of fluctuating pressure levels in third-octave bands. These may be either sound pressure levels from the engines or the levels of aerodynamic flow turbulence. In addition, for new aircraft with structures which differ appreciably from contemporary transport designs, values of parameters which characterize the mass and rigidity of the new structure may be input to the program. Results are printed in tables of third-octave band accelerations, and optionally they may be plotted in graphical form. It is intended that this technical memorandum be used in conjunction with AFFDL-TR-74-74, Appendix I, as a quick and efficient prediction method for acoustically induced vibration in transport aircraft. GRA

N76-31139* Boeing Co., Wichita, Kans.
B-52 CONTROL CONFIGURED VEHICLES: FLIGHT TEST RESULTS
James I. Arnold and Frank B. Murphy *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 75-89 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31147* Lockheed Aircraft Corp., Marietta, Ga.
HISTORICAL REVIEW OF C-5A LIFT DISTRIBUTION CONTROL SYSTEMS
T. E. Disney and D. C. Eckholdt (Wright-Patterson AFB, Ohio) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 295-323 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31152* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
POTENTIAL BENEFITS OF PROPULSION AND FLIGHT CONTROL INTEGRATION FOR SUPERSONIC CRUISE VEHICLES
Donald T. Berry and William G. Schweikhard *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 433-452 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31153* Boeing Aerospace Co., Seattle, Wash.
IPCS IMPLICATIONS FOR FUTURE SUPERSONIC TRANSPORT AIRCRAFT
L. O. Billig, J. Kniat (Pratt and Whitney Aircraft, East Hartford, Conn.), and R. D. Schmidt (Honeywell, Inc., Minneapolis, Minn.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 453-475 (For availability see N76-31135 22-01)
CSCL 01C

N76-31154* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DIGITAL COMPUTER PROPULSION CONTROL FACILITY: DESCRIPTION OF CAPABILITIES AND SUMMARY OF EXPERIMENTAL PROGRAM RESULTS
John R. Zeller, Dale J. Arpasi, and Bruce Lehtinen *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 477-501 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31158* Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DESIGN OF A CONTROL CONFIGURED TANKER AIRCRAFT
Stephen A. Walker *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31159* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
STUDY OF AN ACT DEMONSTRATOR WITH SUBSTANTIAL PERFORMANCE IMPROVEMENTS USING A REDESIGNED JETSTAR
Roy H. Lange (Lockheed-Georgia Co.) and Dwain A. Deets *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31160* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUMMARY OF THE APPLICATION OF ACTIVE CONTROLS TECHNOLOGY IN THE ATT SYSTEM STUDIES
R. V. Hood *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31161* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SURVEY OF ACTIVE CONTROLS BENEFITS TO SUPERSONIC TRANSPORTS
Kermit G. Pratt *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 ref (For availability see N76-31135 22-01)
CSCL 01C

N76-31162* Boeing Commercial Airplane Co., Seattle, Wash.
ESTABLISHING CONFIDENCE IN CCV/ACT TECHNOLOGY
Richard B. Holloway and Henry A. Shomber *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31163* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ACTIVE CONTROL TRANSPORT DESIGN CRITERIA
Bertrand M. Hall and Robert B. Harris (Douglas Aircraft Co., Santa Monica, Calif.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 677-705 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31166* Lockheed-California Co., San Diego.
THE F-12 SERIES AIRCRAFT APPROACH TO DESIGN FOR CONTROL SYSTEM RELIABILITY
F. L. Schenk and J. R. McMaster *In* NASA. Dryden Flight Res. Center Advanced Control Technology and its Potential for Future Transport Aircraft Aug. 1976 p 749-760 (For availability see N76-31135 22-01)
CSCL 01C

N76-31168* Lockheed-California Co., San Diego.
LOCKHEED L-1011 AVIONIC FLIGHT CONTROL REDUNDANT SYSTEMS
E. O. Throndsen *In* NASA. Dryden Flight Res. Center Advanced Control Technology and its Potential for Future Transport Aircraft Aug. 1976 p 779-802 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31169* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE ACT TRANSPORT: PANACEA FOR THE 80'S OR DESIGNER'S ILLUSION (PANEL DISCUSSION)
In its Advanced Control Technology and its Potential for Future Transport Aircraft Aug. 1976 p 805-827 (For availability see N76-31135 22-01)
CSCL 01C

N76-31171* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF METHODS FOR THE ANALYSIS AND EVALUATION OF CCV AIRCRAFT
Robert C. Schwanz *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 895-921 refs (For availability see N76-31135 22-01)
CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-31229*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TURBULENCE INTENSITY INDICATOR Patent Application
Robert A. Champine and Charles W. Meissner, Jr., inventors (to NASA) Filed 23 Sep. 1976 8 p

(NASA-Case-LAR-11833-1; US-Patent-Appl-SN-725828) Avail: NTIS HC $3.50 CSCL 01D

A device for displaying to the pilot or the flight crew of an aircraft the level of turbulence due to rough air over a selected period of time is described. An accelerometer is placed on the aircraft to produce signals of the motion of the aircraft due to rough air. The output from the accelerometer is applied to an absolute value circuit and then to a root square circuit. The output of the root mean square circuit is measured and displayed in the aircraft in view of the flight crew to give an indication of the turbulence. The root mean square circuit includes means for selecting the length of the time period over which the root mean square is obtained. NASA

N76-31174* Sperry Flight Systems, Phoenix, Ariz.
THE IMPLEMENTATION OF FAIL-OPERATIVE FUNCTIONS IN INTEGRATED DIGITAL AVIONICS SYSTEMS
Stephen S. OSoer *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 947-971 (For availability see N76-31135 22-01) CSCL 01D

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-31230*# Kanner (Leo) Associates, Redwood City, Calif.
THE CFM56 TURBOFAN ENGINE. PROGRESS IN THE REDUCTION OF ENGINE NOISE
J. P. Bernard and P. Raffy Washington NASA Aug. 1976 37 p refs Transl. into ENGLISH of conf. paper from Soc. Natl. d'Etude et de Construction de Moteurs d'Aviation, Paris Presented at 12th Intern. Aeronautics Congr., Paris, 29-30 May 1975 p 1-31
(Contract NASw-2790)
(NASA-TT-F-17176) Avail: NTIS HC $4.00 CSCL 21E

The CFM56 is a double-body, dual flow turbofan engine (operating in separated flow and multiphase flow) with 10 tons of thrust. Test facilities for examination of the aerodynamic internal and engine noise characteristics of the turbofan are described. An installation for the determination of the efficacy of acoustic attenuation treatments on the engine is included. Maximum engine noise is plotted as a function of thrust, and noise spectra on landing approach, takeoff, and intermediate flight are presented. Author

N76-31231*# General Electric Co., Cincinnati, Ohio.
EXPERIMENTAL CLEAN COMBUSTOR PROGRAM; NOISE MEASUREMENT ADDENDUM, PHASE 2 Final Report
J. J. Emmerling and K. L. Bekofske Jan. 1976 177 p refs
(Contract NAS3-18551)
(NASA-CR-135045; R75AEG147-13-Add) Avail: NTIS HC $7.50 CSCL 21E

Combustor noise measurements were performed using wave guide probes. Test results from two full scale annular combustor configurations in a combustor test rig are presented. A CF6-50 combustor represented a current design, and a double annular combustor represented the advanced clean combustor configuration. The overall acoustic power levels were found to correlate with the steady state heat release rate and inlet temperature. A theoretical analysis for the attenuation of combustor noise propagating through a turbine was extended from a subsonic relative flow condition to include the case of supersonic flow at the discharge side. The predicted attenuation from this analysis was compared to both engine data and extrapolated component combustor data. The attenuation of combustor noise through the CF6-50 turbine was found to be greater than 14 dB by both the analysis and the data. Author

N76-31232# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CASE STUDY OF PROGRAM EVALUATION AND REVIEW TECHNIQUES AS APPLIED TO THE COMPRESSOR RESEARCH FACILITY PROGRAM M.S. Thesis
Charles V. Thompson Dec. 1975 215 p refs
(AD-A020362; GSM/SM/75D-24) Avail: NTIS CSCL 21/5

The objective of this document is to provide a description of CRF PERT and its advantages and disadvantages in order that a program office wishing to use a PERT system will have adequate decision-making information on CRF PERT available to it. Also included in the thesis is a cost analysis of the system, a section describing the perceptions of Air Force PERT users towards CRF (Compressor Research Facility) PERT, and a suggested user methodology for the system. GRA

N76-31155* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DESCRIPTION AND TEST RESULTS OF A DIGITAL SUPERSONIC PROPULSION SYSTEM INTEGRATED CONTROL
Peter G. Batterton, Dale J. Arpasi, and Robert J. Baumbick *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 503-524 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31181 European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL ANALYSIS OF THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS IN A SUPERSONIC CURVED NOZZLE
Jean Cousteix, Roger Michel et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 1-10 (For availability see N76-31180 22-01)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-31233# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
PROBLEMS AND METHODS IN EVALUATING FORCE STEERING AND OTHER FLIGHT CONTROL MODES: A STUDY AND AN EXPERIMENTAL DESIGN
F. D. Pitrella Dec. 1974 82 p refs
(FB-20) Avail: NTIS HC $5.00; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

To provide guidance for an experimental program, a new aircraft control method, variously called control wheel and force steering control and similar to automanual control, is described. This control method permits pilots to remain in the active control loop during automatic landings and to make inputs without disengaging the autopilot by combining pilot and automatic inputs. The study's end product is a preliminary experimental design for a well controlled experiment using a fixed-base flight simulator to evaluate force steering control and learn ways to optimize it. The study concerns a range of research, measurement, simulation, and aircraft control problems relevant to experimental design questions. Some topics covered are: the nature of force steering control, previous force steering research, the aircraft landing problem, the required degree and fidelity of simulation realism, performance measurement problems, adaptive measurement, control of variable, etc. Author (ESA)

N76-31234# Royal Aircraft Establishment, Bedford (England). Aero/Flight Dept.
A PILOTED FLIGHT SIMULATION OF THE WESTLAND LYNX
T. Wilcock London Aeron. Res. Council 1976 93 p refs Supersedes RAE-TR-74099; ARC-36079
(ARC-CP-1343; RAE-TR-74099; ARC-36079) Avail: NTIS

HC $5.00; HMSO £2.90; PHI

A simulation of the Westland WG 13 Lynx helicopter was carried out using the pilot flight simulator of the Aerodynamics Flight Division, Royal Aircraft Establishment, Bedford, in order to predict the flight handling features of this helicopter, to identify possible problem areas, and to investigate, where appropriate, solutions to these problems. The simulation, conducted in conjunction with Westland Helicopters Ltd., took place about five months before the first flight of the Lynx. Handling features of the helicopter were investigated, including the benefits obtained by stabilization using duplex lanes and the problems associated with runaways of the autostabilization equipment. A brief qualitative comparison of the simulator results with results of flight tests on the actual Lynx was made and areas of effective simulation identified. The need for improved simulator motion and visual cues for certain phases of simulated helicopter flight is noted. Author (ESA)

N76-31136* National Aeronautics and Space Administration, Washington, D.C.
NASA ADVANCED CONTROL TECHNOLOGY: AN OVERVIEW
Peter R. Kurzhals *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 3-35 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31137* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SURVIVABLE FLIGHT CONTROL SYSTEM FLY-BY-WIRE DEVELOPMENT AND FLIGHT TEST
James E. Hunter *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 41-56 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31138* General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DEVELOPMENT OF AN ACTIVE FLY-BY-WIRE FLIGHT CONTROL SYSTEM
Charles A. Anderson *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 57-71 (For availability see N76-31135 22-01)
CSCL 01C

N76-31140* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN OVERVIEW OF NASA'S DIGITAL FLY-BY-WIRE TECHNOLOGY DEVELOPMENT PROGRAM
Calvin R. Jarvis *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 93-103 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31141* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESIGN AND DEVELOPMENT EXPERIENCE WITH A DIGITAL FLY-BY-WIRE CONTROL SYSTEM IN AN F-8C AIRPLANE
Dwain A. Deets *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 105-132 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31142* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
MECHANIZATION OF AND EXPERIENCE WITH A TRIPLEX FLY-BY-WIRE BACKUP CONTROL SYSTEM
Wilton P. Lock, William R. Petersen, and Gaylon B. Whitman (Sperry Flight Systems Div.) *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 133-163 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31143* Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MAN-RATED FLIGHT SOFTWARE FOR THE F-8 DFBW PROGRAM
Robert R. Bairnsfather *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 165-198 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31144* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT TEST EXPERIENCE WITH THE F-8 DIGITAL FLY-BY-WIRE SYSTEM
Kenneth J. Szalai *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 199-252 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31145* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A PILOT'S OPINION OF THE F-8 DIGITAL FLY-BY-WIRE AIRPLANE
Gary E. Krier *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 253-267 ref (For availability see N76-31135 22-01)
CSCL 01C

N76-31148* Lockheed Aircraft Corp., Marietta, Ga.
THE C-5A ACTIVE LIFT DISTRIBUTION CONTROL SYSTEM
William J. Hargrove *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 295-351 (For availability see N76-31135 22-01)
CSCL 01C

N76-31149* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACTIVE CONTROLS FOR RIDE SMOOTHING
D. William Conner and Glenn O. Thompson (Boeing Co., Wichita, Kans.) *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 353-371 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31150* Boeing Commercial Airplane Co., Seattle, Wash.
USE OF ACTIVE CONTROL TECHNOLOGY TO IMPROVE RIDE QUALITIES OF LARGE TRANSPORT AIRCRAFT
Gerald C. Cohen, Clifford J. Cotter, and Donald L. Taylor *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 373-407 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31151* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DECOUPLING CONTROL TECHNOLOGY FOR MEDIUM STOL TRANSPORTS
Daniel K. Bird and Terry L. Neighbor *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 409-429 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31165* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
HANDLING QUALITIES REQUIREMENTS FOR CONTROL CONFIGURED VEHICLES
R. J. Woodcock and F. L. George *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 735-746 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31167* Boeing Co., Wichita, Kans.
B-52 STABILITY AUGMENTATION SYSTEM RELIABILITY
T. C. Bowling and L. W. Key *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 761-778 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31172* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHODOLOGY FOR DESIGN OF ACTIVE CONTROLS FOR V/STOL AIRCRAFT
George Meyer and Luigi Cicolani *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 923-931 (For availability see N76-31135 22-01)
CSCL 01C

N76-31173* Honeywell, Inc., Minneapolis, Minn.
ACTIVE CONTROL SYSTEM TRENDS
Eugene E. Yore and Dale C. Gunderson *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 933-944 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31175* Stanford Research Inst., Menlo Park, Calif.
A FORWARD VIEW ON RELIABLE COMPUTERS FOR FLIGHT CONTROL
Jack Goldberg and John H. Wensley *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 973-988 refs (For availability see N76-31135 22-01)
(Contract NAS1-10920)
CSCL 01C

N76-31176* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE EFFECTS OF LIGHTNING ON DIGITAL FLIGHT CONTROL SYSTEMS
J. Anderson Plumer (GE Co.), Wilbert A. Malloy (General Motors Corp.), and James B. Craft *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 989-1008 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31177* Boeing Commercial Airplane Co., Seattle, Wash.
REDUNDANCY OF HYDRAULIC FLIGHT CONTROL ACTUATORS
C. C. Chenoweth and D. R. Ryder *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 1009-1018 refs (For availability see N76-31135 22-01)
CSCL 01C

N76-31178* Lockheed-Georgia Co., Marietta.
ACTIVE CONTROL TECHNOLOGY AND THE USE OF MULTIPLE CONTROL SURFACES
John E. Hart *In* NASA. Dryden Flight Res. Center Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 1019-1025 (For availability see N76-31135 22-01)
CSCL 01C

N76-31184 European Space Agency, Paris (France).
DETERMINATION OF THE DYNAMIC CHARACTERISTICS OF A HELICOPTER BY THE BRANCH-MODES METHOD
Henri Loiseau and Jacques-Roger Nicholas *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 61-81 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 35-44 (For availability see N76-31180 22-01)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-31235# Materials Research Labs., Maribyrnong (Australia).
A DATA ACQUISITION SYSTEM FOR CLOSED VESSEL TESTING OF GUN PROPELLANTS. PART 1: SOME THEORETICAL CONSIDERATIONS
C. I. Sach Jan. 1976 76 p refs
(Rept-645-Pt-1) Avail: NTIS HC $5.00

Theoretical studies are made of some aspects of a data acquisition system to be used for closed vessel testing of gun propellants. A sampled data system is proposed and factors affecting accuracy are considered so that guidance on sampling rates, store capacity, prefiltering, and digital processing strategies is obtained. Author

N76-31236# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DEVELOPMENT AND TESTING OF A FIXED-BASE HOVERCRAFT SUMULATOR
Andrew J. Fraser Dec. 1975 48 p refs Sponsored by the Canadian Defence Research Board
(UTIAS-TN-197; CN-ISSN-0082-5263) Avail: NTIS HC $4.00

Electrical measurements of control position at the pilot's work station are fed to an analog computer where the equations of motion of the vehicle under study are programmed. The outputs from the analog computer -- vehicle position, orientation, and speed -- are fed to a digital computer via an analog to digital converter. The digital computer then generates, in proper orientation and perspective, a 'wire-frame' image of a road lined with telephone poles and displays it on a cathode ray tube. As the vehicle moves forward, the poles move towards the operator and off the CRT or 'front window'. They are then picked up and displayed in their correct position on peripheral displays or 'side windows'. In order to assess the effectiveness of the peripheral units, an automobile simulation was programmed and a tracking task carried out. When tested to the 95% confidence level, the 8-1/2% improvement in tracking performance with the peripheral units functioning was found to be significant. In addition, subjective comments from those involved in the test program indicated peripheral units facilitated the adjustment to the small display and made it easier to project into the task. Author

N76-31237# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
FLOW PROPERTIES OF SLOTTED WALLS FOR TRANSONIC TEST SECTIONS Interim Report
Sune B. Berndt and Hans Sorensen Oct. 1975 13 p refs Presented at the AGARD Fluid Dyn. Panel Symp. on Wind Tunnel Design and Testing Tech., London, 6-8 Oct. 1975
(Contract AF-AFOSR-2184-72; AF Proj. 9781)
(AD-A023268; AFOSR-76-0187TR; Paper-17) Avail: NTIS CSCL 14/2

A theoretical and experimental study is in progress of the flow through slotted walls under a variety of conditions. The ultimate objective is to make possible accurate numerical computation of transonic flows around models in slotted test sections. This paper is concerned with a slot flow configuration typical of two-dimensional, low lift tests at high subsonic free stream Mach numbers. With the test section empty the slot flow is outwards, into the plenum chamber, and this remains true over a large part of the test section when the model is introduced. From oil flow pictures and pressure measurements in and around the slots it is concluded for the configurations investigated that the slot flow is slightly influenced by the presence of the wall boundary layer, that the flow within the slot is attached and approximately inviscid although influenced by boundary layer formation, that the flow enters the plenum chamber as a thin free jet and that the transverse velocity in the jet and slot is too large for a linear pressure drop equation to be sufficently accurate. When the slot flow turns back over the rear end of the model it may admit stagnant air from the plenum chamber into the test section; the ability of the slot to maintain a pressure difference across the wall is then necessarily reduced. Based on these observations a tentative flow model is proposed, yielding a relationship between the pressure difference across the wall and the transverse velocity through the slots. Improved expressions for the coefficient of the streamline curvature term are obtained, accounting for the depth of the slot and the presence of a jet. GRA

N76-31238# Pennsylvania State Univ., University Park. Applied Research Lab.
THE ARL/FEU(FLUIDS ENGINEERING UNIT) SEMI-

ANECHOIC CHAMBER
G. C. Lauchle and E. Wong 29 Sep. 1975 23 p
(Contract N00017-73-C-1418)
(AD-A021247; TM-75-230) Avail: NTIS CSCL 14/2

This memorandum documents the design and acoustic characteristics of the ARL/Fluids Engineering Unit semi-anechoic chamber. It is located on the first floor of the Garfield Thomas Water Tunnel and has internal dimensions of 11 x 12 x 8 feet. The sound absorbing walls are primarily composed of rock-wool fiberglass insulation, air voids, and wood frame members. Based on measurements of the ambient noise level, reverberation time, transmission loss, and inverse square law, the chamber is considered semi-anechoic for frequencies less than approximately 1kHz and moderately anechoic for greater frequencies. GRA

N76-31170* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCES USING WIND-TUNNEL MODELS IN ACTIVE CONTROL STUDIES
Robert V. Doggett, Jr., Irving Abel, and Charles L. Ruhlin *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 831-892 refs (For availability see N76-31135 22-01)
CSCL 14B

N76-32099 European Space Agency, Paris (France).
IMPROVEMENTS OF THE ONERA ARC 2 B WIND TUNNEL FOR REENTRY PLASMA STUDIES
Joel Fritz *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 17-32a refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 201-211 (For availability see N76-32097 22-99)

N76-32120 European Space Agency, Paris (France).
VISUALISATION OF THE FLOW IN A SUPERSONIC AXIAL COMPRESSOR WITH LONG BLADES
Guy Fertin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 84-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 165-168 (For availability see N76-32116 22-99)

N76-31189 European Space Agency, Paris (France).
EXPERIMENTAL STUDY OF THE INTERNAL NOISE IN INJECTOR DRIVEN WIND TUNNELS
Volker Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 21-30 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 321-324 Presented at 40th Supersonic Tunnel Assoc., Bedford, Engl., 24-26 Sep. 1973 (For availability see N76-31187 22-01)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N76-31239*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
MISSION PLANNING, MISSION ANALYSIS AND SOFTWARE FORMULATION. LEVEL C REQUIREMENTS FOR THE SHUTTLE MISSION CONTROL CENTER ORBITAL GUIDANCE SOFTWARE
L. J. Langston 6 Sep. 1976 92 p refs
(Contract NAS9-14960)
(NASA-CR-150937) Avail: NTIS HC $5.00 CSCL 22A

The formulation of Level C requirements for guidance software was reported. Requirements for a PEG supervisor which controls all input/output interfaces with other processors and determines which PEG mode is to be utilized were studied in detail. A description of the two guidance modes for which Level C requirements have been formulated was presented. Functions required for proper execution of the guidance software were defined. The requirements for a navigation function that is used in the prediction logic of PEG mode 4 were discussed. It is concluded that this function is extracted from the current navigation FSSR. Author

N76-31240*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: REAL-TIME DISPLAY SYSTEM
Cornelius J. Sullivan and LaRue W. Burbank Washington Sep. 1976 15 p
(NASA-TN-D-8316; JSC-S-461) Avail: NTIS HC $3.50 CSCL 22B

The real time display system used in the Apollo Program is described; the systematic organization of the system, which resulted from hardware/software trade-offs and the establishment of system criteria, is emphasized. Each basic requirement of the real time display system was met by a separate subsystem. The computer input multiplexer subsystem, the plotting display subsystem, the digital display subsystem, and the digital television subsystem are described. Also described are the automated display design and the generation of precision photographic reference slides required for the three display subsystems. Author

N76-31241# European Space Agency, Paris (France).
[ACTIVITIES OF THE EUROPEAN SPACE AGENCY] Annual Report, 1975
1976 197 p refs Original contains color illustrations
Avail: NTIS HC $7.50

The ministerial conference in Brussels in mid-April approached the convention for the new agency. The convention was formally signed by the representatives of the ten European countries which had been members of ESRO (and in some cases of ELDO). Ireland also signed the convention. The development programs, including the scientific and meteorological satellite programs COS-B (launched 8 August 1975), GEOS, IUE, ISEE-B, Exosat, Meteosat, the communications satellite programs OTS-ECS, Marots, Aerosat, ATS-6, the Spacelab programs and the Ariane launcher program, are presented. Other program activities involved future program studies, technological research, scientific research, satellite operations and data processing, and space documentation service. Also organization and structure, facilities, external relations, and finance aspects are discussed. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-31242*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
AN ONBOARD DEORBIT TARGET LINE COMPUTATION TECHNIQUE
John J. Bedford Aug. 1976 9 p refs
(Contract NAS9-14960)
(NASA-CR-150939; DN-1.4-4-21) Avail: NTIS HC $3.50 CSCL 22A

The design concept and results of a target line generator software package, which was developed to provide the onboard entry interface range, were documented. This generator, which was eventually reduced to one linear equation, was developed to the point that it provides autonomous landing site relocation capability, negligible core storage, and acceptable performance for the cases tested. Author

N76-31243*# McDonnell-Douglas Corp., St. Louis, Mo.
DISPERSION ANALYSIS FOR BASELINE REFERENCE MISSION 3A WITH 400,000 FOOT ENTRY INTERFACE ALTITUDE
L. S. Snow 26 Aug. 1976 40 p refs
(Contract NAS9-14960)
(NASA-CR-150948; DN-1.4-7-42) Avail: NTIS HC $4.00 CSCL 22A

A dispersion analysis considering 3 beta uncertainties in platform, vehicle, and environmental parameters is described. Powered explicit guidance used to develop closed loop steering commands, the nominal profile, and entry interface conditions

are discussed. The groundrules and assumptions for the analysis are reviewed. The results presented include dispersion data at specific time slices from liftoff to entry interface, covariance matrices, summary data, and exchange ratios. Author

N76-31244# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF ATMOSPHERIC WINDS ON SATELLITE ORBITS OF HIGH ECCENTRICITY
D. G. King-Hele and Doreen M. C. Walker Jan. 1976 31 p refs
(RAE-TR-75150; BR50765) Avail: NTIS HC $4.00

A theory was developed for the effect of zonal and meridional winds on both inclination (i) and the right ascension of the ascending node (omega) for high-eccentricity (greater than 0.2) orbits in an oblate atmosphere. The orbits of earth satellites with perigee heights less than 600 km are liable to be appreciably perturbed by the aerodynamic forces resulting from winds in the upper atmosphere, and analysis of the changes in the orbits provides a method of determining zonal (west-to-east) and meridional (north-to-south) winds. Results are expressed in terms of the change in orbital period, which is accurately known for actual satellites, so that the equations are independent of variations in air density and satellite cross-sectional area; they are also unaffected by lunisolar perturbations unless they are large during one revolution of the satellite. It is shown that the changes delta i and delta omega depend strongly on the value of e, i, and omega. Author (ESA)

N76-31245# Royal Aircraft Establishment, Farnborough (England).
THE EFFECTS OF 15th-ORDER RESONANCE ON THE ORBIT OF NIMBUS 1 ROCKET, 1964-52B
H. Hiller Feb. 1976 18 p refs
(RAE-TR-76001; BR51206) Avail: NTIS HC $3.50

Over 2000 observations from 60 stations were used with the RAE computer program PROP 6 to determine accurately the orbit of Nimbus 1 rocket, 1964-52B, at 25 epochs between March and September 1970. This six-month period covered the main variations resulting from 15th-order resonance, with exact 15th-order resonance on June 5, 1970. The 25 values of orbital inclination obtained had a mean standard deviation of 0.0008 deg, the best sd being 0.0004 deg. These values, together with 16 U.S. Navy values, were analyzed to determine lumped 15th order geopotential coefficients of odd degree, for an inclination of 98.68 deg. A simultaneous fitting of the variations in inclination and eccentricity was performed to obtain lumped values for the coefficients of even degree (16, 18, 20,...). These values will be used with those from satellites with resonant orbits at other inclinations to revise existing values for individual harmonic coefficients of 15th order. Author (ESA)

N76-31246# European Space Agency, Paris (France).
MINIMIZATION OF FUNCTIONS WITH DISCONTINUOUS DERIVATIVES AND NONLINEAR CONSTRAINTS
Ernst-Dieter Dickmanns, N. Engersbach, and R. Schwertassek Apr. 1976 77 p refs Transl. into ENGLISH of "Minimierung von Funktionen mit unstetigen Ableitungen unter nichtlinearen Nebenbedingungen', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-75-69, 23 Oct. 1975 Original German report available from DFVLR, Cologne DM 25,90
(ESA-TT-290; DLR-FB-75-69) Avail: NTIS HC $5.00

The cost function for the minimum fuel positioning procedure of the geostationary satellite Symphonie is not differentiable along certain known curves. The constraints of the resulting parameter optimization problem are of the equality and inequality type. A modification of the Davidon Fletcher inequality constraints is discussed. Numerical results obtained when this modified DFP method was used for the solution of Symphonie specific problems are given as examples. Author (ESA)

N76-31247# European Space Agency, Paris (France).
MODELLING OF THE POSITIONING PROCEDURE STARTING FROM PRIMARY ORBIT FOR THE GEOSTATIONARY SATELLITE SYMPHONIE
Ernst-Dieter Dickmanns, N. Engersbach, R. Schwertassek et al Apr. 1976 68 p refs Transl. into ENGLISH of "Modellierung des Einschussverfahrens fuer den geostationaeren Satelliten Symphonie ab Primaerbahn', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-75-70, 23 Oct. 1975 Original German report available from DFVLR, Cologne DM 25,20
(ESA-TT-291; DLR-FB-75-70) Avail: NTIS HC $4.50

For the computation of the minimum fuel rendezvous of Symphonie with its geostationary target point, a modified gradient projection method was used. The corresponding cost function and mission constraints are modelled. Based on this model a highly flexible software package was developed which can handle a wide range of problems. In the Symphonie project it was used for the mission analysis and after launch in two operational modes: one as a subroutine of a stochastic optimization program to compute the apogee impulse and the other within a second program to determine the orbit corrections after the apogee impulse was executed. Author (ESA)

N76-31248# Air Force Weapons Lab., Kirtland AFB, N.Mex.
ELEMNTS: A COMPUTER PROGRAM FOR THE GENERATION OF ORBITAL ELEMENTS FROM SATELLITE INJECTION DATA Final Report
Neil P. Phillber Jan. 1976 67 p refs
(AD-A020446; AFWL-TR-74-329) Avail: NTIS CSCL 22/3

Program ELEMNTS provides initial conditions appropriate to satellite orbit codes from a set of injection conditions. The injection data supplied to ELEMNTS must include the radius of apogee and perigee, latitude and longitude of the injection point, the inclination of the orbit, the direction of injection, and the time of injection. Computed from the injection conditions are the Classical Keplerian element set and the initial position and velocity vectors in a space inertial frame. Several other quantities of general interest to the user are also computed. ELEMNTS assumes that the perigee point and the injection point are at the same place. The program also assumes that the injection time is between the years 1900 and 2000. A sample problem and a complete listing of the program written in American National Standards Institute FORTRAN are included in this report. GRA

N76-31249# Physical Sciences, Inc., Wakefield, Mass.
ADVANCED REENTRY AEROMECHANICS. VOLUME 1: A REYNOLDS STRESS MODEL FOR BOUNDARY LAYER TRANSITION WITH APPLICATION TO ROUGH SURFACES Interim Scientific Report, 1 Jul. 1974 - 30 Jun. 1975
Michael L. Finson Aug. 1975 44 p refs
(Contract F44620-74-C-0022; AF Proj. 9781)
(AD-A023150; PSI-TR-34; AFOSR-76-0322TR) Avail: NTIS CSCL 16/3

A theory based on the use of second-order moment equations is presented for transitional and turbulent boundary layer flows. The technique yields accurate predictions for various fully turbulent boundary layers, including those affected by pressure gradients and surface roughness. Although the model has yet to be adequately developed for treating transition induced by free-stream turbulence, a method is presented that addresses wall-roughness dominated transition. Using an idealized representation of distributed roughness elements, the disturbances introduced by the elements are described by wake relations and are handled as distributed source or sink terms in the governing relations for mean momentum and fluctuating energy. Representation of actual roughness distributions should be feasible in computations performed with this model. The effects of roughness size and shape on transition are evaluated, and transition is found to be most sensitive to the location of the peaks of the roughness elements. Calculations performed to date compare satisfactorily with the transition measurements on sand paper-roughened flat plates in low speed flow. GRA

N76-32104 European Space Agency, Paris (France).
LONG RANGE OPTIMAL INTERCEPTION. ANALYTICAL APPROACH AND APPLICATION TO INITIAL GUIDANCE IN A VERTICAL PLANE
Nguyen X. Vinh and Jean-Pierre Peltier *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 1-29 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 245-254 (For availability see N76-32103 22-99)

N76-32105 European Space Agency, Paris (France).
AN APPROACH TO THE PROBLEM OF OPTIMAL THREE-

DIMENSIONAL INTERCEPTION BY THE THEORY OF LINEAR QUADRATIC DIFFERENTIAL GAMES
Claude Aumasson *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 30-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 255-266 (For availability see N76-32103 22-99)

N76-32111 European Space Agency, Paris (France).
TRAJECTORY RESTITUTION OF MISSILES OF ARBITRARY CHARACTERISTICS
Huu Thanh Huynh, Dominique Biausse, and Francoise Depasse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 1-29 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 313-326 (For availability see N76-32110 22-99)

N76-32117 European Space Agency, Paris (France).
ANALYTICAL OPTIMIZATION OF THE FINAL POSITIONING OF A GEOSTATIONARY SATELLITE WITH OPERATIONAL CONSTRAINTS
Claude Aumasson and Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 1-39 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 127-143 Presented at Symp. on Optimization Problems in Eng. and Econ., Naples, 16-20 Dec. 1974 (For availability see N76-32116 22-99)

N76-31188 European Space Agency, Paris (France).
LINEAR FILTERING: APPLICATION TO THE SIMULATION OF THE TRAJECTORY AND ATTITUDE RESTITUTION
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 311-319 Presented at the Intern. Seminar on Simulation of Space, Toulouse, 10-14 Sep. 1973 (For availability see N76-31187 22-01)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-31250*# McDonnell-Douglas Astronautics Co., Houston, Tex.
SIMULATOR VERIFICATION TECHNIQUES STUDY. INTEGRATED SIMULATOR SELF TEST SYSTEM CONCEPTS
G. Montoya and T. H. Wenglinski 20 Sep. 1974 45 p
(Contract NAS9-13657)
(NASA-CR-150934; MDC-E1149) Avail: NTIS HC $4.00 CSCL 14B

Software and hardware requirements for implementing hardware self tests are presented in support of the development of training and procedures development simulators for the space shuttle program. Self test techniques for simulation hardware and the validation of simulation performance are stipulated. The requirements of an integrated simulator self system are analyzed. Readiness tests, fault isolation tests, and incipient fault detection tests are covered. S.M.

N76-31251*# Radio Corp. of America, Camden, N.J. Recording Systems.
ASTP VIDEO TAPE RECORDER GROUND SUPPORT EQUIPMENT (AUDIO/CTE SPLITTER/INTERLEAVER). OPERATIONS MANUAL
1 Sep. 1974 238 p
(Contract NAS9-13767)
(NASA-CR-147884; Doc-564-395) Avail: NTIS HC $8.00 CSCL 22D

A descriptive handbook for the audio/CTE splitter/interleaver (RCA part No. 8673734-502) was presented. This unit is designed to perform two major functions: extract audio and time data from an interleaved video/audio signal (splitter section), and provide a test interleaved video/audio/CTE signal for the system (interleaver section). It is a rack mounting unit 7 inches high, 19 inches wide, 20 inches deep, mounted on slides for retracting from the rack, and weighs approximately 40 pounds. The following information is provided: installation, operation, principles of operation, maintenance, schematics and parts lists. Author

N76-31252*# Radio Corp. of America, Camden, N.J. Recording Systems.
ASTP VIDEO TAPE RECORDER GROUND SUPPORT EQUIPMENT, ADDENDUM 1 (CTE SPLITTER/BUFFER). OPERATIONS MANUAL
1 Jan. 1975 120 p
(Contract NAS9-13767)
(NASA-CR-147885; Doc-564-395-Add-1) Avail: NTIS HC $5.50 CSCL 22D

A descriptive handbook for the CTE splitter (RCA part No. 8673734-503) was presented. This unit is designed to extract time data from an interleaved video audio signal. It is a rack mounting unit 7 inches high, 19 inches wide, 20 inches deep, mounted on slides for retracting from the rack, and weighs approximately 40 pounds. The following information is provided: installation, operation, principles of operation, maintenance, schematics and parts lists. Author

N76-31253*# Radio Corp. of America, Camden, N.J. Recording Systems.
ASTP VIDEO TAPE RECORDER GROUND SUPPORT EQUIPMENT, ADDENDUM 2 (CTE SPLITTER/BUFFER). OPERATIONS MANUAL
1 Jan. 1975 129 p
(Contract NAS9-13767)
(NASA-CR-147886; Doc-564-395-Add-2) Avail: NTIS HC $6.00 CSCL 22D

A descriptive handbook for the CTE splitter (RCA part No. 8673734-50A) was presented. This unit is designed to extract time data from an interleaved video/audio signal. It is a rack mounting unit 7 inches high, 19 inches wide, 20 inches deep, mounted on slides for retracting from the rack, and weighs approximately 40 pounds. The following information is provided: installation, operation, principles of operation, maintenance, schematics and parts lists. Author

N76-31254# European Space Agency, Paris (France).
ESTIMATION OF THE FLOW CONDUCTANCE OF SHROUDS IN SPACE SIMULATION CHAMBERS
Hans Hamacher May 1976 43 p refs Transl. into ENGLISH of "Beitr. zur Abschaetzung des Leitwertes von Kaltwaenden in Raumsimulationskammern"; DFVLR, Cologne Report DLR-FB-76-05, 12 Jan. 1976 Original German report available from DFVLR, Cologne DM 19.40
(ESA-TT-297; DLR-FB-76-05) Avail: NTIS HC $4.00

Space simulation chambers often contain cryosurfaces (shrouds) which enclose the test specimen tightly against light leakage. The total conductance of the shrouds is determined by the conductance values of the shroud openings and of the space between shroud and chamber wall. Equations which take both influences into consideration were developed. For the case of the uncooled shroud the ratio between the net pumping speed available in the test space and the pumping speed in the level of the chamber entrance was determined. Deductions were based on a model which represents the space between shroud and chamber as a cylindrical chamber. The results are discussed with respect to the design parameters which come into consideration. The above discussed problem is demonstrated by applying the design values of the 2.5 m space simulation chamber of the DFVLR. Author (ESA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-31255 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TABLE OF ARTIFICIAL SATELLITES, 1957 - 1975 [TABLEAU DES SATELLITES ARTIFICIELS 1957 - 1975]
J. Vercheval 1976 196 p In FRENCH; ENGLISH summary
(Aeronomica-Acta-F-24-1976) Avail: Issuing Activity

The numbers of successful launchings until 31 December 1975 are summarized. A table of all the satellites is then given in alphabetical order, followed by a brief description of the missions for the various types of satellites. Finally, the chronology of manned space flight is presented. Author (ESA)

N76-31256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS-6 USER'S GUIDE
John E. Sissala, ed. (Management and Technical Services Company, Beltsville, Md.) Feb. 1975 241 p refs
(Contract NAS5-20694)
(NASA-TM-X-74147) Avail: NTIS HC $8.00 CSCL 05B

Background information was given on the Nimbus 6 spacecraft and experiments as a basis for selecting, obtaining, and utilizing Nimbus 6 data in research studies. The basic spacecraft system operation and the objectives of the Nimbus 6 flight are outlined, followed by a detailed discussion of each of the experiments. The format, archiving, and access to the data are also described. Finally, the contents and format of the Nimbus 6 data catalogs are described. These catalogs will be issued periodically after the launch of Nimbus 6. They will contain representative pictorial data and daily temperature, humidity, infrared and radiometer data obtained during each period, as well as information on the collection and availability of all Nimbus 6 data. Author

N76-31257*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NATURAL ENVIRONMENT DESIGN REQUIREMENTS FOR THE SPACELAB
George S. West and Jerry J. Wright Sep. 1976 8 p refs
(NASA-TM-X-73330) Avail: NTIS HC $3.50 CSCL 22B

The natural environment design requirements for the Spacelab, carried to orbital altitudes as cargo in the space shuttle bay, were presented. This includes consideration of the following: neutral atmosphere, charged particles, radiation (galactic cosmic, trapped, and solar particle events), meteoroids, and astrodynamic constants. Author

N76-31258*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRY WORKSHOP ON LARGE SPACE STRUCTURES: EXECUTIVE SUMMARY
Ellis Katz Washington NASA Sep. 1976 16 p
(Contract NAS1-12436)
(NASA-CR-2709) Avail: NTIS HC $3.50 CSCL 22B

A NASA-sponsored Industry Workshop on Large Space Structures was convened at Langley Research Center on 24-26 February 1976. A number of structures specialists from seven major aerospace companies participated. Predictions about the future structures to be fabricated/assembled/erected in space are presented along with a composite appraisal of what the Aerospace Industry views as the critical structural technology developments needed to support NASA space missions in the 1985-2000 time frame. Author

N76-31259# Sandia Labs., Albuquerque, N.Mex.
NOSETIP RECOVERY VEHICLE POST FLIGHT DEVELOPMENT REPORT
E. A. English Jan. 1976 279 p refs
(Contract AT(29-1)-789)
(SAND-75-8059) Avail: NTIS HC $9.25

The nosetip recovery vehicle (NRV) was successfully flown on September 18, 1975. This event marked the first time that a high performance reentry vehicle had been soft landed and recovered. The vehicle weighed 102 lb and had a ballistic coefficient of 2,000 psf. The recovered portion, which weighed 40 lb, included the nosetip, most of the heat shield, and a portion of the telemetry/instrumentation. The vehicle was designed to fly trajectories typical of an intercontinental ballistic missile. Fuzing functions for the recovery system were supplied by a dual channel inertial fuze. The deceleration necessary to effect a soft landing was obtained by jettisoning about 60 percent of the vehicle mass, then deploying a two stage parachute. A ram air flotation bag and homing beacon on top of the main chute provided the additional capability for recovery from ocean areas. Author (ERA)

N76-31260# Royal Aircraft Establishment, Farnborough (England).
TABLE OF SPACE VEHICLES: 1973 - 1975
J. A. Pilkington Dec. 1975 16 p Supersedes RAE-TM-SPACE-219; N75-33151
(RAE-TM-SPACE-228; BR50483; RAE-TM-SPACE-219) Avail: NTIS HC $3.50

Space vehicles successfully launched before December 31, 1972, are listed. Data reported include launch date, mass and basic shape, basic size, perihelion, aphelion, eccentricity, inclination to ecliptic, and duration. The orbits are classified into heliocentric orbits, orbits in the earth-moon system, selenocentric orbits, aerocentric orbits, and orbits round Venus. ESA

N76-31261# Construcciones Aeronauticas S.A., Madrid (Spain). Div. Espacial.
FLUID PHYSICS MODULE
J. M. Ruesga Jun. 1976 164 p refs
(Contract ESA-SC/95-HQ)
(ESA-CR(P)-816) Avail: NTIS HC $6.75

The feasibility of a liquid floating zone module to be used onboard Spacelab was investigated. Topics dealt with include flow equilibrium disturbance; fluid flow visualization; zone length and volume; liquid handling; zone protection; image recording system; characteristics of the fluids to be used; and technical parameters of the module and environment isolation. The costs of the experiment were estimated at 26,250,000 pesetas. ESA

N76-31262# Tri-Con Associates, Inc., Cambridge, Mass.
DESIGN, DEVELOP, FABRICATE AND TEST INSTRUMENTATION FOR A ROCKET-BORNE MEASUREMENT OF ATMOSPHERIC DENSITY Final Report, 1 Mar. - 30 Nov. 1975
William B. Huber 30 Nov. 1975 36 p
(Contract F19628-75-C-0124; AF Proj. 6690)
(AD-A023482; C-136; AFGL-TR-76-0040) Avail: NTIS CSCL 04/2

Instrumentation to measure atmospheric density in the 100 km to 160 km altitude region was designed, fabricated, and tested. The instrumentation consisted of two 4.5 kev electron beams, pulsed synchronously with the telemetry Pulse Code Modulation format, each with an average beam current of one milliampere. Observation of the beam induced brehmsstrahlung was made with two proportional counters with Krypton gas fill and 2 mil beryllium windows. Observation of the ultraviolet fluorescence was made with three photometers using narrow band 3914 A filters. This report presents the sensor specifications and details the electrical design of the instrumentation. Author (GRA)

N76-31263# Naval Research Lab., Washington, D.C.
DYNAMICS OF SATELLITE DISINTEGRATION Final Report
Robert Dasenbrock, Bernard Kaufman, and William Heard 30 Jan. 1976 45 p refs
(NRL Proj. B01-17)
(AD-A020931; NRL-7954) Avail: NTIS CSCL 22/3

Satellite disintegration is examined in detail. Elements of the orbits of individual fragments, determined by DOD space-surveillance systems, are used to accurately determine the time and place of the fragmentation. Dual time-independent and time-dependent analyses are performed for simulated and real breakups. Methods of statistical mechanics are used to study the evolution of the fragment clouds by treating the fragments as an ensemble of noninteracting particles. A solution of Liouville's

equation is obtained which enables the spatial density to be calculated as a function of position, time, and initial velocity distribution. Conversely, a relation is established between the observed fragment distribution and the time of fragmentation and initial velocity distribution. The probability of collision between a spacecraft and a fragment cloud is calculated. GRA

N76-31264# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A BANDWIDTH CONSERVING APPROACH TO MULTIPLE ACCESS SATELLITE COMMUNICATION FOR MOBILE TERMINALS
Brian E. White and Russell M. Mersereau 17 Dec. 1975 118 p refs
(Contract F19628-76-C-0002)
(AD-A022556; TN-1975-26; ESD-TR-75-329) Avail: NTIS CSCL 17/2

The problem of efficiently packing many mobile user signals into the available UHF uplink bandwidth of an advanced communications satellite is considered. The basic approach is FDMA with QPSK modulated data streams individually modified by spectral shaping using data windows. From extensive computer simulations it is concluded that with relatively little degradation 20 unsynchronized 16 kbps satellite users can be packed into a 500 kHz uplink bandwidth that is shared with terrestrial LOS allocations. Alternatively, 7 unsynchronized 2400 bps users can occupy a 25 kHz bandwidth. Signal strengths may vary by as much as 10 to 15 dB at the satellite without the need for transmitter power control. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N76-31265*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
APPLICATION OF SHUTTLE EVA SYSTEMS TO PAYLOADS. VOLUME 1: EVA SYSTEMS AND OPERATIONAL MODES DESCRIPTION
Jun. 1976 201 p refs
(Contract NAS9-14678)
(NASA-CR-147732; MDC-W0014-Vol-1) Avail: NTIS HC $7.75 CSCL 22B

Descriptions of the EVA system baselined for the space shuttle program were provided, as well as a compendium of data on available EVA operational modes for payload and orbiter servicing. Operational concepts and techniques to accomplish representative EVA payload tasks are proposed. Some of the subjects discussed include: extravehicular mobility unit, remote manipulator system, airlock, EVA translation aids, restraints, workstations, tools and support equipment. Author

N76-31266*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
APPLICATION OF SHUTTLE EVA SYSTEMS TO PAYLOADS. VOLUME 2: PAYLOAD EVA TASK COMPLETION PLANS
Jun. 1976 338 p refs
(Contract NAS9-14678)
(NASA-CR-147733; MDC-W0014-Vol-2) Avail: NTIS HC $10.00 CSCL 22B

Candidate payload tasks for EVA application were identified and selected, based on an analysis of four representative space shuttle payloads, and typical EVA scenarios with supporting crew timelines and procedures were developed. The EVA preparations and post EVA operations, as well as the timelines emphasizing concurrent payload support functions, were also summarized. Author

N76-31267*# TRW Systems Group, Redondo Beach, Calif.
HP-9810A CALCULATOR PROGRAMS FOR PLOTTING THE 2-DIMENSIONAL MOTION OF CYCLINDRICAL PAYLOADS RELATIVE TO THE SHUTTLE ORBITER
S. W. Wilson 16 Aug. 1976 74 p refs
(Contract NAS9-14723)
(NASA-CR-150918; TRW-28415-H003-RO-00) Avail: NTIS HC $4.50 CSCL 22B

The HP-9810A calculator programs described provide the capability to generate HP-9862A plotter displays which depict the apparent motion of a free-flying cyclindrical payload relative to the shuttle orbiter body axes by projecting the payload geometry into the orbiter plane of symmetry at regular time intervals. Author

N76-31268*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE
Washington 1976 97 p Original contains color illustrations
(NASA-SP-407; LC-76-600045) Avail: NTIS MF $3.00; SOD HC $3.40 CSCL 22B

The space shuttle flight system and mission profile are briefly described. Emphasis is placed on the economic and social benefits of the space transportation system. The space shuttle vehicle is described in detail. J.M.S.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-31269*# McDonnell-Douglas Astronautics Co., Houston, Tex.
SIMULATION VERIFICATION TECHNIQUES STUDY: SIMULATION PERFORMANCE VALIDATION TECHNIQUES DOCUMENT
L. M. Duncan, J. P. Reddell, and P. B. Schoonmaker 27 Jan. 1975 343 p refs
(Contract NAS9-13657)
(NASA-CR-150933; MDC-E1136) Avail: NTIS HC$10.00 CSCL 22B

Techniques and support software for the efficient performance of simulation validation are discussed. Overall validation software structure, the performance of validation at various levels of simulation integration, guidelines for check case formulation, methods for real time acquisition and formatting of data from an all up operational simulator, and methods and criteria for comparison and evaluation of simulation data are included. Vehicle subsystems modules, module integration, special test requirements, and reference data formats are also described. Author

N76-31270*# Chrysler Corp., New Orleans, La. Space Division.
TRANSITION HEATING RATES OBTAINED ON A MATTED AND ISOLATED 0.006 SCALE MODEL (41-OT) SPACE SHUTTLE ORBITER AND EXTERNAL TANK IN THE NASA/LARC VARIABLE DENSITY HYPERSONIC TUNNEL (IH17)
J. Cummings (Rockwell Intern.) Jul. 1976 650 p
(Contract NAS9-13247)

(NASA-CR-144594; DMS-DR-2015) Avail: NTIS HC $16.25 CSCL 22B

Model information and data obtained from wind tunnel tests performed on a 0.006 scale model of the Rockwell International space shuttle orbiter and external tank in the 18 inch Variable Density Hypersonic Wind Tunnel (VDHT) at NASA Langley Research Center are presented. Tests were performed at a Mach number of 8.0 over a Reynolds Number range from 0.1 to 10.0 million per foot at 0 deg and -5 deg angle of attack and 0 deg sideslip angle. Transition heating rates were determined using thin skin thermocouples located at various locations on the orbiter and ET. The test was conducted in three stages: orbiter plus external tank (mated configuration); orbiter alone, and external tank alone. The effects of boundary layer trips were also included in the test sequence. The plotted results presented show the effect of configuration interference on the orbiter lower surface and on the ET. Tabulated data are given. Author

N76-31271*# Chrysler Corp., New Orleans, La. Space Division.

TRANSONIC HIGH REYNOLDS NUMBER STABILITY AND CONTROL CHARACTERISTICS OF A 0.015-SCALE REMOTELY CONTROLLED ELEVON MODEL (44-0) OF THE SPACE SHUTTLE ORBITER TESTED IN CALSPAN 8-FOOT TWT (LA70)

Harry Parrell (Rockwell Intern.) and Joe D. Gamble (NASA. Johnson Space Center) Jul. 1976 1040 p refs

(Contract NAS9-13247)

(NASA-CR-147624; DMS-DR-2269) Avail: NTIS HC $28.25 CSCL 22B

Transonic Wind Tunnel tests were run on a .015 scale model of the space shuttle orbiter vehicle in the 8-foot transonic wind tunnel. Purpose of the test program was to obtain basic shuttle aerodynamic data through a full range of elevon and aileron deflections, verification of data obtained at other facilities, and effects of Reynolds number. Tests were performed at Mach numbers from .35 to 1.20 and Reynolds numbers from 3,500,000 to 8,200,000 per foot. The high Reynolds number conditions (nominal 8,000,000/foot) were obtained using the ejector augmentation system. Angle of attack was varied from -2 to +20 degrees at sideslip angles of -2, 0, and +2 degrees. Sideslip was varied from -6 to +8 degrees at constant angles of attack from 0 to +20 degrees. Aileron settings were varied from -5 to +10 degrees at elevon deflections of -10, 0, and +10 degrees. Fixed aileron settings of 0 and 2 degrees in combination with various fixed elevon settings between -20 and +5 degrees were also run at varying angles of attack. Author

N76-31272*# Howard Univ., Washington, D.C. Dept. of Mechanical Engineering.

THE DYNAMICS OF SPIN STABILIZED SPACECRAFT WITH MOVABLE APPENDAGES, PART 2 Final Report

Peter M. Bainum May 1976 122 p refs

(Contract NsG-1181)

(NASA-CR-148815) Avail: NTIS HC $5.50 CSCL 22B

The dynamics and stability of a spin stabilized spacecraft with a hinged appendage system are treated analytically and numerically. The hinged system consists of a central hub with masses attached to (assumed) massless booms of fixed length whose orientation relative to the main part can change. The general three dimensional deployment dynamics of such a hinged system is considered without any restriction on the location of the hinge points. The equations of motion for the hinged system, with viscous damping at both hinge points, are linearized about the nominal equilibrium position where the booms are orthogonal to the nominal spin axis for the case of two dimensional and three dimensional motion. Analytic stability criteria are obtained from the necessary condition on the sign of all the coefficients in the system characteristic equation. Author

N76-31273*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PERFORMANCE OF A MULLITE REUSABLE SURFACE INSULATION SYSTEM IN A HYPERSONIC STREAM

L. Roane Hunt Washington Aug. 1976 39 p refs Original contains color illustrations

(NASA-TM-X-3397; L-10861) Avail: NTIS HC $4.00 CSCL 22B

The thermal and structural performance of a large panel of mullite reusable surface insulation (RSI) tiles was determined by a series of aerothermal tests in the Langley 8-foot high-temperature structures tunnel. The test panel was designed to represent a portion of the surface structure on a space shuttle orbiter fuselage along a 1,150 K isotherm with the mullite tile system bonded directly to the primary structure. Aerothermal tests were conducted at a free-stream Mach number of 6.7, a total temperature of 1,880 K, a unit Reynolds number of 4.6 million per meter, and dynamic pressure of 62 kPa. The thermal response of the mullite tile was as predicted, and the bond-line temperature did not exceed the design level of 570 K during a typical entry-heat cycle. Geometric irregularities of the tile gaps affected the tile edge temperatures when exposed to hypersonic flow. The tile coating demonstrated good toughness to particle impacts, but the coating cracked and flaked with thermal cycles. The gap filler of woven silica fibers appeared to hinder flow penetration into the gaps and withstood the flow shear of the present tests. Author

N76-31274# Royal Aircraft Establishment, Farnborough (England).

THE PROSPERO THERMAL CONTROL SURFACES EXPERIMENT

G. E. Keyte Dec. 1975 109 p refs

(RAE-TR-75123; BR50460) Avail: NTIS HC $5.50

The Prospero Thermal Control Surfaces Experiment was conceived as a method of investigating the behavior of various thermal control surface materials in a space environment. The results of laboratory tests on selected materials, the design and construction of the experiment and the analysis of data obtained from the flight of the Prospero spacecraft are described. The experiment was not sensitive enough to measure changes in surface radiation properties accurately, but it was possible to identify some surfaces as being satisfactory for use and reject others as being unsatisfactory. Author (ESA)

N76-31275# Royal Aircraft Establishment, Farnborough (England).

AN ATTITUDE-CONTROL SYSTEM FOR AN EARTH-POINTING SKYLARK ROCKET

R. J. Jude Dec. 1975 35 p refs

(RAE-TR-75133; BR50456) Avail: NTIS HC $4.00

A three-axis attitude control system for a Skylark sounding rocket, which enables the vehicle to be used as a platform for earth-observation experiments, is described. The design constraints, in particular those arising from this type of experiment, are specified, and the design criteria for parts of the control system explained. The control system employs earth albedo horizon sensors in the roll and pitch axes and has velocity control about the yaw axis. The components which comprise the system are described together with their disposition in the vehicle. The performance of the control system in flight is tabulated for the prototype SL1081, and for the first two production vehicles SL1181 and SL1182. Possible improvements in the performance of the control system are suggested. Author (ESA)

N76-31276# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

SATELLITE ATTITUDE ESTIMATION WITH MEASUREMENTS AVAILABLE AT RANDOM POINTS IN TIME Final Report

Stuart M. Melzer 10 Dec. 1975 24 p refs

(Contract F04701-75-C-0076)

(AD-A020969; SAMSO-TR-76-26; TR-0076(6111)-6) Avail: NTIS CSCL 22/1

The state, measurement model, and linear filter for estimating the three small rotation angles between the measured attitude of a spacecraft and the actual attitude of the spacecraft are developed. The measured spacecraft and actual spacecraft have different attitudes due to gyro errors. The measurements available for the small angle estimation are voltage pip time caused by star images crossing slits on the reticles of star sensors rigidly mounted to the spacecraft body. Attitude measurements are generated by comparing one component of the catalogued star vector in the actual spacecraft frame with the same component in the measured spacecraft frame. The pip times for each slit are modeled as a Poisson counting process. This assumption

leads to derivation of a suboptimal filter using a gain that is independent of the pip arrival time sequence. Author (GRA)

N76-31146* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE DIGITAL FLIGHT CONTROL SYSTEM
Glenn M. Minott (Rockwell Intern. Corp.), John B. Peller (Rockwell Intern. Corp.), and Kenneth J. Cox *In its* Advanced Control Technol. and its Potential for Future Transport Aircraft Aug. 1976 p 271-294 (For availability see N76-31135 22-01)
CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-31277*# Rice Univ., Houston, Tex.
SCIENTIFIC SUPPORT OF THE APOLLO INFRARED SCANNING RADIOMETER EXPERIMENT Final Report
Wendell W. Mendell Apr. 1976 236 p refs
(Contract NAS9-10428)
(NASA-CR-150945) Avail: NTIS HC $8.00 CSCL 14B

The Infrared Scanning Radiometer (ISR) was designed to map the thermal emission of the lunar surface from the service module of the orbiting Apollo 17 spacecraft. Lunar surface nighttime temperatures, which are extremely difficult to map from earth based telescopes were measured. The ISR transmitted approximately 90 hours of lunar data spread over 5 days in lunar orbit. Approximately 10 to the 8th power independent lunar temperature measurements were made with an absolute accuracy of 2K. Spatial resolution at nadir was approximately 2.2 km (depending on orbital altitude), exceeding that of earth based measurements by at least an order of magnitude. Preliminary studies of the data reveal the highest population of thermal anomalies (or hot spots) in Oceanus Procellarum. Very few anomalies exist on the far side of the moon as was predicted from the association of anomalies with mare on the near side. A number of negative anomalies (or cold spots) have also been found. Author

N76-31278*# TRW Systems Group, Redondo Beach, Calif.
A COST AND UTILITY ANALYSIS OF NIM/CAMAC STANDARDS AND EQUIPMENT FOR SHUTTLE PAYLOAD DATA ACQUISITION AND CONTROL SYSTEMS. VOLUME 1: SUMMARY
30 Jun. 1976 51 p 3 Vol.
(Contract NAS9-14693)
(NASA-CR-147852) Avail: NTIS HC $4.50 CSCL 14B

The cost effectiveness of utilizing the Nuclear Instrumentation Modular (NIM) and the Computer Automated Measurement Control (CAMAC) equipment for Spacelab payload instrumentation was determined. Representative shuttle sortie payloads were analyzed for applicability and commonality. Modification of NIM/CAMAC equipment was analyzed for its suitability in Spacelab environments and to determine the cost. NIM/CAMAC equipment usage requirements for Spacelab payloads were converted to pool size requirements and time-phased equipment procurement requirements. A programmatic estimate of the pool equipment costs and a management plan were prepared for the pool concept. The implementation and impact of CAMAC software were assessed. S.M.

N76-31279*# TRW Systems Group, Redondo Beach, Calif.
A COST AND UTILITY ANALYSIS OF NIM/CAMAC STANDARDS AND EQUIPMENT FOR SHUTTLE PAYLOAD DATA ACQUISITION AND CONTROL SYSTEMS. VOLUME 2: TASKS 1 AND 2
30 Jun. 1976 267 p refs 3 Vol.
(Contract NAS9-14693)
(NASA-CR-147853) Avail: NTIS HC $9.00 CSCL 14B

A representative set of payloads for both science and applications disciplines were selected that would ensure a realistic and statistically significant estimate of equipment utilization. The selected payloads were analyzed to determine the applicability of Nuclear Instrumentation Modular (NIM)/Computer Automated Measurement Control (CAMAC) equipment in satisfying their data acquisition and control requirements. The analyses were combined with the comparable results from related studies to arrive at an overall assessment of the applicability and commonality of NIM/CAMAC equipment usage across the spectrum of payloads. S.M.

N76-31280*# TRW Systems Group, Redondo Beach, Calif.
A COST AND UTILITY ANALYSIS OF NIM/CAMAC STANDARDS AND EQUIPMENT FOR SHUTTLE PAYLOAD DATA ACQUISITION AND CONTROL SYSTEMS. VOLUME 3: TASKS 3 AND 4
30 Jun. 1976 145 p refs 3 Vol.
(Contract NAS9-14693)
(NASA-CR-147854) Avail: NTIS HC $4.50 CSCL 14B

The modifications for the Nuclear Instrumentation Modular (NIM) and Computer Automated Measurement Control (CAMAC) equipment, designed for ground based laboratory use, that would be required to permit its use in the Spacelab environments were determined. The cost of these modifications were estimated and the most cost effective approach to implementing them were identified. A shared equipment implementation in which the various Spacelab users draw their required complement of standard NIM and CAMAC equipment for a given flight from a common equipment pool was considered. The alternative approach studied was a dedicated equipment implementation in which each of the users is responsible for procuring either their own NIM/CAMAC equipment or its custom built equivalent. S.M.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-31281*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
ORBITAL MANEUVERING ENGINE FEED SYSTEM COUPLED STABILITY INVESTIGATION, COMPUTER USER'S MANUAL
M. D. Schuman, K. W. Fertig, J. K. Hunting, and D. R. Kahn 1 Sep. 1975 382 p refs
(Contract NAS9-14315)
(NASA-CR-150944; R-9808) Avail: NTIS HC $10.75 CSCL 21H

An operating manual for the feed system coupled stability model was given, in partial fulfillment of a program designed to develop, verify, and document a digital computer model that can be used to analyze and predict engine/feed system coupled instabilities in pressure-fed storable propellant propulsion systems over a frequency range of 10 to 1,000 Hz. The first section describes the analytical approach to modelling the feed system hydrodynamics, combustion dynamics, chamber dynamics, and overall engineering model structure, and presents the governing equations in each of the technical areas. This is followed by the program user's guide, which is a complete description of the structure and operation of the computerized model. Last, appendices provide an alphabetized FORTRAN symbol table, detailed program logic diagrams, computer code listings, and sample case input and output data listings. Author

N76-31282*# Lockheed Missiles and Space Co., Huntsville, Ala.
A TRANSONIC AND SURPERSONIC INVESTIGATION OF JET EXHAUST PLUME EFFECTS ON THE AFTERBODY AND BASE PRESSURES OF A BODY OF REVOLUTION
C. Donald Andrew and C. E. Cooper, Jr. Mar. 1974 735 p refs
(Contract NAS8-26801)
(NASA-CR-149989; LMSC-HREC-TM-D306909) Avail: NTIS

HC $18.75 CSCL 21H

An experimental aerodynamic investigation was conducted to provide data for studies to determine the criteria for simulating rocket engine plume induced aerodynamic effects in the wind tunnel using a simulated gaseous plume. Model surface and base pressure data were obtained in the presence of both a simulated and a prototype gaseous plume for a matrix of plume properties to enable investigators to determine the parameters that correlate the simulated and prototype plume-induced data. The test program was conducted in the Marshall Space Flight Center's 14 x 14-inch trisonic wind tunnel using two models, the first being a strut mounted cone-ogive-cylinder model with a fineness ratio of 9. Model exterior pressures, model plenum chamber and nozzle performance data were obtained at Mach numbers of 0.9, 1.2, 1.46, and 3.48. The exhaust plume was generated by using air as the simulant gas, or Freon-14 (CF4) as the prototype gas, over a chamber pressure range from 0 to 2,000 psia and a total temperature range from 50 to 600 F.

Author

N76-31283*# Textron Bell Aerospace Co., Buffalo, N.Y.
SPACE SHUTTLE ORBIT MANEUVERING ENGINE REUSABLE THRUST CHAMBER PROGRAM Final Summary Report
John M. Senneff May 1975 74 p
(Contract NAS9-12803)
(NASA-CR-147859; BAC-8693-950002) Avail: NTIS HC $4.50 -CSCL 21H

The feasibility of potential reusable thrust chamber concepts is studied. Propellant condidates were examined and analytically combined with potential cooling schemes. A data base of engine data which would assist in a configuration selection was produced. The data base verification was performed by the demonstration of a thrust chamber of a selected coolant scheme design. A full scale insulated columbium thrust chamber was used for propellant coolant configurations. Combustion stability of the injectors and a reduced size thrust chamber were experimentally verified as proof of concept demonstrations of the design and study results.

Author

N76-31284# Rocket Propulsion Establishment, Westcott (England).
A SELF FEEDING GAS GENERATOR
J. Diederichsen Oct. 1975 16 p refs
(RPE-Memo-665; BR51296) Avail: NTIS HC $3.50

The design is suggested of a self pressurizing system for liquid propellant gas generators, without moving parts other than those in a nonreturn valve, when the bulk of the gas produced by the gas generator is used to drive an acoustic oscillator, and the peak pressures from the oscillations are returned to the liquid propellant tank. Using nitrogen at ambient temperature for a model test at moderate pressures, sufficient high pressure gas can be withdrawn from the oscillator; however, a nonreturn valve which operates satisfactorily at high temperature would have to be developed.

Author (ESA)

N76-31285# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHUTTING DOWN THE SOLID FUEL ROCKET ENGINE
Todor Andreev 7 Jan. 1976 11 p Transl. into ENGLISH from Voenna Tekhnika (Bulgaria), v. 8, no. 1, 1974 p 26-28
(AD-A020461; FTD-ID(RS)I-2418-75) Avail: NTIS CSCL 21/8

Up to now there are two ways known for shutting down a solid rocket engine, or stopping the thrust; extinguishing the burning fuel, and neutralization of the thrust (reversing the thrust). These two methods can be applied separately or combined.GRA

N76-31286# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
THRUSTER CONTAMINATION PREDICTIONS FOR NATO 3 SATELLITE Final Report, Sep. - Dec. 1975
Larry P. Davis and I. Lee Witbracht Dec. 1975 65 p refs
(AF Proj. 5730)
(AD-A020587; AFRPL-TR-75-67) Avail: NTIS CSCL 22/2

Potential contamination of the NATO III Satellite surfaces by the efflux from its hydrazine thrusters has been studied. The CONTAM computer code, coupled with empirical data for estimation of mass flux in the plume backflow regions and for calculation of vaporization rates from the spacecraft surfaces, was used for the analysis. Two types of thruster operations, short pulse trains for attitude maneuvers and long pulse trains for altitude maneuvers, were considered. The results show that only small net deposits of water and hydrazine are to be expected on a small percentage of the total spacecraft solar panel area at temperatures of -72F. In addition, these deposits will have a very short residence time on these surfaces. Limitations in the analysis are presented, and their impact on the conclusions are discussed.

GRA

N76-31287# Ultrasystems, Inc., Irvine, Calif.
A COMPUTER PROGRAM FOR THE PREDICTION OF SOLID PROPELLANT ROCKET MOTOR PERFORMANCE, VOLUME 3 Final Report
D. E. Coats, J. N. Levine, G. R. Nickerson, T. J. Tyson, and N. S. Cohen Jul. 1975 235 p refs
(Contract F04611-73-C-0038; AF Proj. 3059)
(AD-A022880; AFRPL-TR-75-36-Vol-3) Avail: NTIS CSCL 21/8

A flexible, modular, fully automated, solid rocket motor performance prediction program has been developed. The program, which has been given the acronym SPP is based on six pre-existing computer codes. These codes have been integrated and modified, as required. To supplement the theory, where necessary, and to increase the flexibility of the program, a number of existing and newly developed semi-empirical correlations were incorporated into the program. The program has a general three-dimensional grain design capability, coupled to a one-dimensional ballistics analysis. The deviations from ideal performance are computed as a series of independent efficiencies. GRA

N76-32107 European Space Agency, Paris (France).
RESPONSE OF A SOLID PROPELLANT TO A PRESSURE STEP
Jean Brulard, Paul Kuentz, and Roger Kling *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 87-109 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 279-287 (For availability see N76-32103 22-99)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-31288 Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Lab. de Spectrographie de Bondy.
INVESTIGATION ON METHODS OF ANALYSIS BY ATOMIC ABSORPTION SPECTROSCOPY USING FLAMELESS ATOMIZING SOURCES (OVEN OR FILAMENT THERMAL ATOMIZATION) Final Report [RECHERCHE SUR LES METHODES D'ANALYSE PAR SPECTROMETRIE D'ABSORPTION ATOMIQUE A L'AIDE DES SOURCES D'ATOMISATION SANS FLAMME (ATOMISATION THERMIQUE EN FOUR OU SUR FILAMENT)]
Maurice Pinta and Christian Riandey Sep. 1974 27 p refs In FRENCH
(Contract DGRST-72-7-0769)
Avail: Issuing Activity

The use of electrical ovens as atom generators in the atomic absorption spectrochemical analysis of either pure elements or elements in matrices is discussed. The atomizing mechanism of some elements in simple media ((NO3)2 Pb, Cr2O7K2, and molybdenum) is investigated. Some perturbation effects in the atomization due to acids or cations are investigated for high volatile compound elements (Cd, Pb, K), less volatile compound elements, particularly the oxides (Mo, V) contained in complex media. Ways of preventing the interference effects in the atomization are outlined and applied to the analysis of trace elements in complex media such as rocks, soils, waters, plants, industrial products, and atmospheric dust.

ESA

N76-31289# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
THE PREPARATION OF RADIOACTIVELY LABELLED ORGANOPHOSPHORUS COMPOUNDS ON A SEMIMICRO-SCALE. PART 1: THE SYNTHESIS OF ALKYL METHYL PHOSPHONO FLUORIDATES (G AGENTS) LABELLED WITH P-32
C. deBorst 30 Jul. 1975 19 p refs
(CL-1975-13; TDCK-66549) Avail: NTIS HC $3.50

A number of alkyl methyl phosphono fluoridates labelled with radioactive phosphorus were prepared. These are isopropyl methyl phosphono fluoridate, cyclohexyl methyl phosphono fluoridate, and the pinacolyl methyl phosphono fluoridate and are highly toxic compounds known as G-agents. The starting material was irradiated red phosphorus. The syntheses were carried out on a semimicroscale. The preparations of the intermediates are also described. Chemical and radiochemical purities are given as well as experimental details of the synthesis and of the especially designed apparatus. Author (ESA)

N76-31290# European Space Agency, Paris (France).
SYNTHESIS OF PARTIALLY FLUORINATED PHOSPHORIC DIARYL ALKYL ESTERS AND THEIR POTENTIAL APPLICATION AS ADDITIVES AND/OR BASE OILS
Heribert Lindinger and Ludwig Fanghaenel Dec. 1975 35 p refs Transl. into ENGLISH of "Syn. partiell fluorierter asymmetrischer Phosphorsaeure-di-arylester-alkylester u. deren moegliche Verwendung als Additive bzw. Grundoele", DFVLR, Munich Report DLR-FB-74-69, 25 Oct. 1974 Original German report available from DFVLR, Porz, West Ger. DM 17.50
(ESA-TT-223; DLR-FB-74-69) Avail: NTIS HC $4.00

The synthesis of partially fluorinated asymmetric phosphoric diaryl alkyl esters by gradual esterification of phosphorus oxychloride with phenol and its substitution products and fluorinated aliphatic alcohols is discussed. The products were investigated for their potential application as load carrying additives and/or base oils. Viscosity, viscosity/temperature characteristic, and pour point of a number of these phosphoric diaryl alkyl esters were determined. Additive effectiveness was studied using sebacic di-(2-ethyl hexyl-)ester as the base oil and tricresyl phosphate as the reference additive. Lubricity was investigated using the four ball wear tester. Author (ESA)

N76-31291# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
INORGANIC COORDINATION POLYMERS. PART 20. ZINC (2) PHOSPHINATE POLYMERS AND COPOLYMERS CONTAINING PHENYL SULFONE SIDE GROUPS
Piero Nannelli, H. D. Gillman, Harold G. Monsimer, and Shyam B. Advani Dec. 1975 18 p refs
(Contract N00014-69-C-0122; NR Proj. 356-408)
(AD-A020185; TR-17) Avail: NTIS CSCL 07/2

The synthesis and characterization of a series of new phosphinic acids and the zinc polymers and copolymers prepared from them are reported. These compositions are characterized by the presence of phenyl sulfone side groups. The zinc derivatives were found to be among the most thermally stable tractable poly(metal phosphinates) yet studied. GRA

N76-31292# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
INORGANIC COORDINATION POLYMERS. PART 19. STERIC EFFECTS OF HYDROCARBON SIDE GROUPS ON THE STRUCTURE AND PROPERTIES OF ZINC (2), COBALT (2), MANGANESE (2), NICKEL (2) AND COPPER (2) BIS(PHOSPHINATES)
H. D. Gillman and J. L. Eichelberger Dec. 1975 21 p refs
(Contract N00014-69-C-0122; Nr Proj. 356-408)
(AD-A020184; TR-16) Avail: NTIS CSCL 07/2

The metal(2) dialkylphosphinates M[OPR2O]2 (with M = Mn, Co, Ni, Cu and Zn; R = -C(CH3)3, -CH2CH2CH2CH3 and -CH(CH3)CH2CH2CH3) were investigated. The structures of the complexes with straight chain R substituents vary for the different metals and include polymers with both octahedrally and tetrahedrally coordinated metal centers. On the other hand, the metal(2) phosphinates that contain bulky alkyl R substituents all appear to have the same structure, which contains tetrahedrally coordinated metal centers and symmetrically bridging O,O' phosphinate groups. Author (GRA)

N76-31293*# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
NBS SPACE PROCESSING RESEARCH Annual Report, 1 Nov. 1974 - 31 Dec. 1975
E. Passaglia and R. L. Parker Feb. 1976 216 p refs
(NASA Order W-13475)
(NASA-CR-148804; PB-250849/7; NBSIR-76-980) Avail: NTIS HC $7.75 CSCL 20B

Ground based studies are performed of those aspects of space that could possibly provide a unique environment for making materials more perfect or more pure. Experimental and theoretical studies of the possible effects of the absence of gravitational forces on those materials preparation processes are made where the presence of gravity may be important in reducing perfection or purity. The materials preparation processes studied comprise six tasks in the areas of crystal growth, purification and chemical processing, and the preparation of composites. Author (GRA)

N76-31294# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
HIGHLY HALOGENATED ORGANIC AND ORGANOMETALLIC MATERIALS AND STRAINED RING ORGANOMETALLICS Final Scientific Report, 1 Oct. 1971 - 31 Aug. 1975
Dietmar Seyferth 15 Dec. 1975 16 p refs
(Grant AF-AFOSR-2204-72; AF Proj. 9538)
(AD-A023132; AFOSR-76-0163TR) Avail: NTIS CSCL 07/3

A brief summary of research results of the period 1 Oct. 1973 - 31 August 1975 on new organometallic (Hg and Pb) Divalent Carbon Transfer Agents, new carbene chemistry, halogenated organomagnesium and -lithium reagents and the first silacyclopropanes. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N76-31295 Connecticut Univ., Storrs.
FATIGUE BEHAVIOR OF SHORT GRAPHITE FIBERS REINFORCED NYLON 66 COMPOSITES Ph.D. Thesis
Gideon Salee 1976 160 p
Avail: Univ. Microfilms Order No. 76-18999

The fabrication of fiber composites using the techniques of vacuum compression and injection molding is examined. Specimens of random in plain short graphite fibers reinforced nylon which were prepared by the vacuum compression technique show relatively high (74%-84%) fiber efficiencies. Even though close control of the processing conditions was kept, a wide distribution of strength and modulus values was observed. For injection molded specimens a narrower distribution of strength and modulus value was observed, which indicates that injection molding is a more reproducible process. In injection molded specimens, fiber breakage and orientation in the flow direction are evident. The breaking stress distribution of both populations conforms to simple two parameter Weibull model. Cyclic fatigue experiments were run at 10 Hertz frequency under constant stress amplitude.
Dissert. Abstr.

N76-31296 Virginia Univ., Charlottesville.
ANALYTICAL AND EXPERIMENTAL STUDIES OF A GLASS REINFORCED PLASTIC FLEXURAL MEMBER Ph.D. Thesis
Husamettin Alper 1976 155 p
Avail: Univ. Microfilms Order No. 76-18087

The problem studied was the analytical and experimental investigation of a fiberglass-reinforced plastic flexural member. A geometric shape was adopted which consisted of two Pratt trusses joined together in a V-shape by a common lower chord and connected at the top by a solid plate top chord. The web diagonals and lower chord of the member were built-up elements of filament-wound fiberglass, while the top chord and vertical web elements were prefabricated plate and rod shapes of reinforced plastics. As each specimen was loaded to failure, design modifications were made in subsequent specimens based on the observed modes of failure and the theoretical analyses. The main problem encountered in the behavior of these members was the failure of the top flange joints under relatively low loads. A three-dimensional finite element model was used for

the analysis of the specimens. The strains and deflections measured during load tests were linear, and in general, in acceptable agreement with analytical predictions. Dissert. Abstr.

N76-31297 Centre de Recherches de la Compagine Generale d'Electricite, Marcoussis (France). Div. Electrotechnique Generale.
STUDY OF THE BEHAVIOR OF SULFUR HEXAFLUORIDE AND OF INSULATING MATERIAL IN SF6 UNDER HIGH ELECTRIC CONSTRAINTS Final Report [ETUDE DU COMPORTEMENT DE L'HEXAFLUORURE DE SOUFRE ET DE STRUCTURES ISOLANTES DANS SF6 SOUS CONTRAINTE ELECTRIQUE ELEVEE]
J. C. Bobo and J. Donon Nov. 1974 27 p refs In FRENCH
(Contract DGRST-73-7-1845)
Avail: Issuing Activity

The stability of sulfur hexafluoride under severe electric conditions was tested. The following topics are discussed: dielectric stability of SF6 in homogeneous and in divergent electric fields; influence of gas pressure and of the nature and surface of the electrodes; dielectric stability of SF6 with electric waves of different forms; study of predisrupting currents; dielectric behavior of insulating material in SF6; and stability of mixtures of SF6 with other gases (freon, nitrogen). ESA

N76-31298*# United Technologies Research Center, East Hartford, Conn.
MULTI-FIBER COMPOSITES Final Report
R. C. Novak Apr. 1976 107 p refs
(Contract NAS3-18941)
(NASA-CR-135062; R76-912098-11) Avail: NTIS HC $5.50 CSCL 11D

Resin matrix composites having improved resistance to foreign object damage in gas turbine engine fan blade applications were developed. Materials evaluated include epoxy matrix graphite/glass and boron/glass hybrids, thermoplastic matrix boron/glass hybrids, and superhybrids consisting of graphite/epoxy, boron/aluminum, and titanium alloy sheets. Static, pendulum impact, and ballistic impact test results are reported for all materials. Superhybrid blade like specimens are shown to be capable of withstanding relatively severe ballistic impacts from gelatin spheres without fracture. The effects of ply configuration and projectile angle of incidence on impact behavior are described. Predictions of surface strains during ballistic impact are presented and shown to be in reasonable agreement with experimental measurements. Author

N76-31299*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
ADVANCED COMPOSITES: ENVIRONMENTAL EFFECTS ON SELECTED RESIN MATRIX MATERIALS
Erwin K. Welhart 31 Mar. 1976 36 p refs
(Contract NAS9-14960)
(NASA-CR-150938; DN-1.2-DN-B0104-2) Avail: NTIS HC $4.00 CSCL 11D

The effects that expected space flight environment has upon the mechanical properties of epoxy and polyimide matrix composites were analyzed. Environmental phenomena covered water immersion, high temperature aging, humidity, lightning strike, galvanic action, electromagnetic interference, thermal shock, rain and sand erosion, and thermal/vacuum outgassing. The technology state-of-the-art for graphite and boron reinforced epoxy and polyimide matrix materials is summarized to determine the relative merit of using composites in the space shuttle program. Resin matrix composites generally are affected to some degree by natural environmental phenomena with polyimide resin matrix materials less affected than epoxies. S.M.

N76-31300# National Research Council of Canada, Ottawa (Ontario).
IONIC THEORY OF SILICATE MELTS
B. Pretnar 1976 16 p refs Transl. into ENGLISH from Berichte der Bunsengesellschaft fuer Physikalische Chemie (W. Germany), vol. 72, no. 7, 1968 p 773-778
(NRC/CNR-TT-1878; ISSN-0077-5606) Avail: NTIS HC $3.50

An expression is derived mathematically for the distribution of polymerized silicate anions in binary silicate melts of varing composition. The regularities which are valid in the chemistry of polymer substances are applied to polymerized silicate anions. The structural peculiarities of the polymerized silicate anions are taken into account and are expressed mathematically. The definitions as well as the mutual dependences of polymerization parameters are discussed, and a way is shown for their calculation from thermodynamic data. Author

N76-31301*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A LIMITING ANALYSIS FOR EDGE EFFECTS IN ANGLE-PLY LAMINATES
Peter W. Hsu and Carl T. Herakovich Sep. 1976 34 p refs
(Grants NGR-47-004-090; NGR-47-004-129)
(NASA-CR-148813; VPI-E-76-18) Avail: NTIS HC $4.00 CSCL 11D

A zeroth order solution for edge effects in angle ply composite laminates using perturbation techniques and a limiting free body approach was developed. The general method of solution for laminates is developed and then applied to the special case of a graphite/epoxy laminate. Interlaminar stress distributions are obtained as a function of the laminate thickness to width ratio h/b and compared to existing numerical results. The solution predicts stable, continuous stress distributions, determines finite maximum tensile interlaminar normal stress for two laminates, and provides mathematical evidence for singular interlaminar shear stresses. Author

N76-31302# Royal Aircraft Establishment, Farnborough (England).
FATIGUE TESTING OF CARBON FIBRE REINFORCED PLASTICS
J. B. Sturgeon Dec. 1975 41 p refs
(RAE-TR-75135; BR50457) Avail: NTIS HC $4.00

Unidirectional carbon fiber reinforced plastic (CFRP) was tested in fatigue using waisted and rectangular specimens. Comparisons were also made between notched, waisted, and plain rectangular test pieces using material oriented at 0 plus or minus 45 deg. It is concluded that, when testing CFRP to obtain basic materials property data, a plain rectangular specimen is the most suitable. Three types of fiber - high modulus, medium modulus, and low modulus - were compared for their fatigue performance in laminates and it was found that the higher the fiber modulus the smaller the influence of dynamic loadings. Intralaminar shear tests, using plus or minus 45 deg specimens tested in tension, show creep is induced by fatigue loadings and that CFRP of this orientation is sensitive to cyclic shear stresses. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-31303 Columbia Univ., New York.
HYPERFINE-STRUCTURE MEASUREMENTS IN EXCITED STATES OF ALKAI ATOMS BY CW LASER SPECTROSCOPY Ph.D. Thesis
Pericles Tsekers 1976 70 p
Avail: Univ. Microfilms Order No. 76-18484

The absolute value of the hyperfine structure coupling constants a and b in the excited states of Rb-87, Cs-133, and Na-23 were measured using a CW tunable dye laser in a two step excitation scheme. The D-2(3/2) levels were investigated using the level crossing technique, while the D-2(5/2), P-2(1/2), and S-2(1/2) levels were investigated with the optical double resonance technique. Results are presented. Dissert. Abstr.

N76-31304 Purdue Univ., Lafayette, Ind.
COMPUTERIZED APPLICATIONS OF COMBINED GAS CHROMATOGRAPHY - MASS SPECTROMETRY

Ph.D. Thesis
Allen Thomas Shepard 1975 146 p
Avail: Univ. Microfilms Order No. 76-20398

Chromatographic methods which could be carried out through the use of a high precision gas chromatograph with a mass-sensitive detector were illustrated. In the first study, principal-component analysis provided a relatively rapid means for determining if there are two or more components in a single chromatographic peak when using the equivalent of a multi-channel detector. For a two component system, changes in the shape of the plot for the scalars of the two major vectors were examined as functions of the extent of the overlap of the distributions, the relative amounts of the two components, and the tailing of peaks. In the second study a high-precision gas chromatograph was used in conjunction with a quadrupole mass spectrometer and an on-line computer to study the fractionation of carbon and oxygen isotopes in carbon dioxide on two solid adsorbents and on a variety of liquid phases. For adsorption studies, the relative retention is reported as a function of temperature on Porapak Q and silica gel. Dissert. Abstr.

N76-31305*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRICAL PROPERTIES OF PETROLEUM COKE FROM PIPELINE CRUDE OIL
Bohdan Kalinowski and Rafal Wlodarski Washington NASA Sep. 1976 8 p refs Transl. into ENGLISH from Przemysl Chem. (Warsaw), v. 47, no. 7, 1968 p 408-410
(Contract NASw-2790)
(NASA-TT-F-17208) Avail: NTIS HC $3.50 CSCL 07D

The electrical properties of petroleum coke, based on an evaluation of its resistivity, were determined. An electrical method, using Thomson's Bridge circuit was used to measure the resistivity of the coke in granular or grain form. Apparatus enabling the samples to be tested under a gage pressure up to 200 at. was used. The petroleum coke samples were 0.14 mm in diameter, and their volume was 4 cu cm. Prior to testing, the samples were treated at temperatures ranging from 1,100 deg to 2,700 deg for 1-5 hours. The test current of 10 A was passed through the samples at room temperature. A simultaneous increase in the coke heat treatment time and treatment temperature resulted in a decrease in resistivity. Coke heat treated at 1,100-1,300 deg showed a sharp decrease in resistivity; at 1,300 deg the rate leveled off. The heat treatments result in an internal change in coke affecting its electrical properties -- these changes are similar to those in other kinds of coke. Indications show that petroleum coke has strong tendencies toward graphitization. The changes in electrical properties of petroleum coke are similar to those in other types of coke. Author

N76-31306*# Ionics Research, Inc., Houston, Tex.
FLIGHT CONTAMINANT TRACE ANALYSER. PHASE 1: CHROMATOGRAPHIC INPUT SYSTEM Final Report
Albert Zlatkis Sep. 1976 17 p ref
(Contract NAS9-14763)
(NASA-CR-150942) Avail: NTIS HC $3.50 CSCL 07D

The purpose of this investigation was to develop two chromatographic columns which would enable a mass spectral identification of 40 specified compounds. The columns are for use in a toxic gas analyzer, which incorporates an automated gas chromatograph-mass spectrometer. Different types of stationary phases were investigated. The columns used were of the open tubular capillary type and were made of nickel. Limitations of initial and final temperature of operation led to final development of a column which could resolve most of the compounds required. The few unresolved components are capable of resolution and identification by the mass spectrometer. The columns (182m Ni x 0.8m O.D x 0.5mm I.D) coated with Witconal La 23, yielded in excess of 200,000 theoretical plates and completed the analysis in less than 90 minutes using a carrier gas flow rate of 4 cc/min hydrogen. Author

N76-31307# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
THE SPHERICAL BOMB METHOD FOR LAMINAR BURNING VELOCITY DETERMINATION: EQUIPMENT, EXPERIMENTAL PROCEDURE AND DATA HANDLING
A. M. Garforth and C. J. Rallis Jan. 1976 158 p refs
(ISBN-0-85494-367-6; Rept-65) Avail: NTIS HC $6.75

The apparatus, calibrations, experimental procedure, photographic record transcription and computerized data reduction techniques used in a spherical bomb method program for laminar burning velocity determination are described. Author

N76-31308# National Research Council of Canada, Ottawa (Ontario). Institute for Scientific and Technical Information.
VERTICAL FLAME SPEED OF FABRICS
T. T. Lie 1976 16 p refs
(NRC/CNR-TT-1855; ISSN-0470-2557) Avail: NTIS HC $4.00

A method is described that enables reasonably accurate measurement of the speed of flame propagation and flame intensity by using wires with a well defined melting point. Based on this method the vertical flame speed of various materials is evaluated. The method is suitable for use in other areas in which the speed of propagation of flame front is of interest. Author

N76-31309# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.
LIGHT SCATTERING FROM ELECTROCHEMICAL INTERFACES
Gerard Blondeau and Ernest Yeager 1 Jan. 1976 84 p refs
(Contract N00014-75-C-0953; NR Proj. 359-451)
(AD-A022453; TR-43) Avail: NTIS CSCL 07/4

Specific topics covered in this review include: (1) Mechanisms for the electromodulation of the reflectance of metal-electrolyte interfaces involving surface conductivity, surface plasmons, bound electronic state contributions and ionic double layer effects; (2) Optical models for the quantitative interpretation of the reflectance changes caused by adsorbed layers; (3) Optical studies of adsorption kinetics; (4) Optical techniques for the study of surface roughness. GRA

N76-31310# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDIES OF THE EVENTS OCCURRING AT GAS EVOLVING ELECTRODES M.S. Thesis
R. A. Putt Oct. 1975 75 p refs
(Contract W-7405-eng-48)
(LBL-3989) Avail: NTIS HC $4.50

Physical events associated with the evolution of hydrogen and oxygen at electrode surfaces in concentrated sulfuric acid and potassium hydroxide solutions were observed and recorded by flash photography. A technique for photographing the electrode surface shortly after current initiation (13-300 ms) provided a view unobstructed by rising gas bubbles. Bubble growth rate, number density, and maximum bubble size data were obtained for gas generation rates in the range 3.5 - 14 cu cm/sq cm min, corresponding to current densities for hydrogen evolution of 0.5 to 2 A/cm. The velocity of the rising gas emulsion and degree of gas bubble coalescence within it were also observed. The growth characteristics of bubbles depend strongly on the electrolyte composition, different for hydrogen and oxygen in the same electrolyte. In the range studied, increasing the gas generation rate does not change the character of the events, only the rate of their occurrence. Author (ERA)

N76-31311# Pittsburgh Univ., Pa. Dept. of Chemistry.
MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY Progress Report, 1 Feb. 1975 - 31 Jan. 1976
D. W. Pratt 1 Nov. 1975 29 p refs
(Contract AT(11-1)-3435)
(COO-3435-28) Avail: NTIS HC $4.00

Zero-field and high-field optical detection of magnetic resonance (ODMR), electron paramagnetic resonance (EPR), and optical spectroscopy experiments were performed on several systems in order to further basic knowledge of the structure, reactions, and response to radiation of atoms, molecules, and ions. Results on the following studies are reported: the direct observation of level anticrossing and mixing effects in excited molecular triplet states; anomalous zero-field splittings in the lowest triplet state of 1-iodonaphthalene; evidence for second-order spin-orbit coupling and spin delocalization effects in the lowest triplet state of benzophenone; direct observation of the optical absorption spectra of reactive free radicals at room temperature; and measurements of the activation and thermody-

namic parameters of several cyclohexenyl and cyclohexanonyl radicals. Author (NSA)

N76-31312# European Space Agency, Paris (France).
DEVELOPMENT OF THE COMBUSTION ZONE IN A STABILIZED TURBULENT FLAME
Vir Pratap Singh May 1976 57 p refs Transl. into ENGLISH of "Develop. de la Zone de Combust. dans une Flamme Turbulente Stabilisee"; ONERA, Paris Report ONERA-NT-1975-7, 1975
(ESA-TT-294; ONERA-NT-1975-7) Avail: NTIS HC $4.50

A method of theoretical analysis for studying the turbulent flames stabilized in hot gases flowing at a high velocity is proposed. The theory is based on the basic parameters of turbulent combustion rate and required combustion time. The results of the numerical calculations were compared with the experimental results. The experiments were carried out in a combustion chamber 1,300 mm long and 100 mm x 100 mm in cross section. Premixed and preheated air-methane mixtures were supplied to the combustion chamber, and the flame was initiated and stabilized by a parallel secondary flow of hot burnt gases. Inlet velocities varied from 28 to 80 m/s. The pressure plots along the axis of the combustion chamber were used to derive the two parameters of turbulent combustion. Results indicate the presence of a strong flame-generated turbulence. A theoretical analysis of a combustion chamber of revolution was discussed. The study was extended to the case of a turbojet after-burner in which flames are stabilized with one or several annular flame holders.
Author (ESA)

N76-31313# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
THERMODYNAMIC PROPERTIES OF BULK AND OCCLUDED SUPERCOOLED WATER AND IONIC SOLUTIONS Technical Report, 1 Jul. 1972 - 30 Dec. 1975
C. A. Angell 30 Dec. 1975 30 p refs Sponsored in part by the Interior Dept.
(PB-251543/5; W76-06155; TR-75; OWRT-B-051-IND(7)) Avail: NTIS HC $4.00 CSCL 07D

Techniques were developed for performing quantitative determinations, of the heat capacity, compressibility, and near infrared spectra of pure water, D2O, and their electrolyte solutions under conditions of supercooling. The heat capacity, compressibility, and negative expansivity are increasing exponentially with decreasing temperature according to a function which suggests the existence of a thermodynamic singularity at -45C. This phenomenon is dependent on extended water water interactions since it is rapidly eliminated by addition of electrolytes such as LiCl. A concentrated aqueous electrolyte solution, 5.5 m lithium acetate, is found to form a glass for which the glass transition temperature pressure dependence is negative. GRA

N76-31314# Environmental Protection Agency, Athens, Ga.
TECHNIQUES FOR OPTIMIZING A QUADRUPOLE GC/MS/COMPUTER SYSTEM
Mike H. Carter Mar. 1976 35 p refs
(PB-252026/0; EPA-600/4-76-004) Avail: NTIS HC $4.00 CSCL 14B

Techniques and procedures were developed for maintaining the stability and maximizing the sensitivity of the Finnigan 1015-System 150 Gas Chromatograph/Mass Spectrometer/Computer (GC/MS/Computer) System. Causes of instability include poor vacuum tube performance and high temperature in the electronics chassis. Sensitivity is maximized by appropriate maintenance and adjustment techniques. Methods have been developed for increasing the utility of the data collected by the GC/MS/Computer system. These include techniques for acquiring better data and for extracting the most information from the data that have been acquired. This report was submitted in partial fulfillment of ROAP 16ADN Task 27 at the Environmental Research Laboratory, Athens, Georgia. Work was completed as of April 1974. GRA

N76-31315# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
ANALYSIS OF NITROGEN TRIFLUORIDE Final Report
Louis A. Dee Apr. 1976 23 p refs
(AD-A022887; AFRPL-TR-76-20) Avail: NTIS CSCL 07/2

A gas chromatography technique for the analysis of NF3 is described wherein N2(O2), CO, NO, CF4, NF3, CO2, N2O, SF6 and possibly N2F2 are separated isothermally on a single column. In addition, a simple total reactive fluoride measurement is presented. Author (GRA)

N76-31316# California Univ., Berkeley. Dept. of Chemical Engineering.
THE REACTIVITY AND STRUCTURE OF SOLID SURFACES, PHASE 2 Final Report, 1 Nov. 1971 - 31 Jul. 1975
Robert P. Merrill 22 Jan. 1976 15 p refs
(Grant AF-AFOSR-2218-72; AF Proj. 9536)
(AD-A023260; AFOSR-76-0152TR) Avail: NTIS CSCL 07/4

Atomic and molecular beam scattering has been used along with LEED, Auger spectroscopy, and temperature programmed-desorption to study the structure of silver, platinum, tungsten, and iridium surfaces, and the interaction of helium, neon, argon, krypton, xenon, oxygen, hydrogen, methane, nitrogen, and carbon monoxide with these metal surfaces. Scattering of the rare gases displayed non-diffractive, quasi-elastic scattering for He/Ag(111), inelastic scattering for Ne, Ar, Kr/Ag(111), and trapping-dominated scattering for Xe/Ag(111). Rare gas scattering of He/W(112) gave quasi-elastic diffraction, Ne/W(112) gave inelastic rainbow scattering, and Ar, Kr, Xe/W(112) gave trapping-dominated scattering. The quasi-elastic helium diffraction has been represented well by semi-classical theory which can be extended to other surface scattering problems, including LEED. Scattering of polyatomic molecules has shown, that except for the hydrogenic molecules, rotational coupling is very weak compared to translational coupling. Adsorbed oxygen on Pt(111) results in a (2x2) LEED pattern but the surface mesh of the Pt(110) is unchanged for the adsorption at low temperatures in the reactive state. This surface chemistry on the single crystal plane is sufficient to explain quantitatively the oxygenation of carbon monoxide in a commercial catalytic muffler. GRA

N76-31317# Emory Univ., Atlanta, Ga. Dept. of Chemistry.
GASEOUS SAMPLE COMPRESSION AS A MEANS OF INCREASING SENSITIVITY IN GAS CHROMATOGRAPHIC ANALYSIS
Lester Wei and Myron Kaufman 22 Mar. 1976 9 p refs
(Contract N00014-75-C-0200)
(AD-A023075; Rept-11) Avail: NTIS CSCL 07/4

A Teflon bag is employed as a variable volume in compressing low pressure gaseous samples to atmospheric pressure prior to their injection into a gas chromatograph. A large increase in sensitivity with no concomitant decrease in either the resolution or linearity of the analysis is achieved by this technique.
Author (GRA)

N76-31318# California Univ., Irvine. Dept. of Chemistry.
A STUDY OF ELECTRONICALLY EXCITED NITROGEN DIOXIDE IN ITS FIRST PREDISSOCIATION REGION: FLUORESCENCE EMISSION, LIFETIMES, AND ELECTRONIC QUENCHING Final Report, 1 Apr. 1975 - 31 Mar. 1976
William M. Uselman and Edward K. C. Lee 10 Mar. 1976 24 p refs
(Contract N00014-75-C-0813; NR Proj. 014-506)
(AD-A023073; B-2) Avail: NTIS CSCL 07/4

Fluorescence behavior of NO2 in the first predissociation region (3979 to 4200 A) was studied in great detail with fluorescence excitation spectroscopy and the phase-shift technique for the lifetimes measurement. The predissociation limit is determined to be about 3980 A. A fluorescing species with a constant intrinsic lifetime of about 7 x .00007 sec and a predissociating species with a very short lifetime (10 to the minus 7 power sec) are found. Author (GRA)

N76-31319# IBM Watson Research Center, Yorktown Heights, N.Y.
PHOTOCHEMICAL ADDITION OF BENZENE TO UNSATURATED MATERIALS Final Scientific Report, 1 Dec. 1971 - 30 Nov. 1975
R. Srinivasan Jan. 1976 20 p refs
(Contract F44620-72-C-0024)
(AD-A023086; AFOSR-76-0168TR) Avail: NTIS CSCL 07/4

The photochemical 1,3-addition reaction of benzene, several alkyl benzenes, and anisole to a variety of linear, monocyclic,

and bicyclic olefins has been studied from both mechanistic and synthetic points of view. The addition takes place with retention of the stereochemistry at the olefin and with a high degree of orientational specificity. The reaction is believed to originate in the lowest singlet excited state of the aromatic and may involve an exciplex as an intermediate. The quantum yields for the addition at the limit of the olefin concentration fall in a range from 0.1 to 0.5. A model for the exciplex which accounts for all of the observations and has considerable predictive value for the reactivity and orientational effects that are observed in different olefins has been proposed. Two classes of reactions of the photochemical adducts have been investigated in detail. These are the thermal rearrangements, particularly of the adducts of benzene to cyclobutene, and the acid catalyzed rearrangements. All of the 1,3-adducts are sensitive to pyrolysis. At about 280 degrees, in the vapor phase in a static system, the reactions that are observed are reversal of the photoaddition, a 1,5-sigmatropic shift of hydrogen, and the vinylcyclopropane rearrangement. The adducts of cyclobutene also undergo a (2'-vinylcyclopropyl) cyclobutane rearrangement, a hitherto unknown 1,5-sigmatropic shift of a C-C bond. The course of this reaction has been studied by deuterium labeling. Acid catalyzed opening of the 1,3-adducts results in the breaking of the cyclopropane ring to give bicyclo 3.2.1 octane-8-01 derivatives. The sterochemistry of this rearrangement was established. GRA

N76-31320# IIT Research Inst., Chicago, Ill.
A STUDY OF PAN-TYPE COMPOUNDS AND RELATED PRECURSORS Final Ecological Research Series Report
Max Lustig and Irvine J. Solomon Jan. 1976 21 p refs
(Grant EPA-R-802966-01)
(PB-250559/2; EPA-600/3-76-012) Avail: NTIS HC $3.50 CSCL 07C

An ideal preparative procedure for PAN was found, high yields of PAN were obtained, and a satisfactory preparative g.l.c. technique was adapted for its purification. The results of the synthetic studies tend to confirm prior conclusions, but the decomposition of PAN does not proceed entirely the way previously described. The results from this research indicate that the acyl and acylperoxy radicals are precursors to PAN in photochemical environments containing acyl derivatives, NOx, and oxygen. Additional characterization data was obtained that corroborate the structure established for PAN. GRA

N76-31321# National Bureau of Standards, Washington, D.C. Physical Chemistry Div.
SELECTED THERMOCHEMICAL DATA COMPATIBLE WITH THE CODATA RECOMMENDATIONS Interim Report
V. B. Parker, D. D. Wagman, and D. Garvin Jan. 1976 35 p refs Sponsored in part by Intern. Atomic Energy Agency, Vienna
(PB-250845/5; NBSIR-75-968) Avail: NTIS HC $4.00 CSCL 07D

Selected thermochemical properties data at 298.15 K are given for 384 substances. The set of values is suitable for use as auxiliary data in evaluations of the thermochemical properties of compounds of the actinide elements. Rules used in the conversion of units and the rounding of numbers are stated. GRA

N76-32114 European Space Agency, Paris (France).
PROPANE COMBUSTION IN A PERFECTLY STIRRED COMBUSTOR
Jean Duterque and Roland Borghi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 69-90 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 347-357 (For availability see N76-32110 22-99)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-31322 Maryland Univ., College Park.
AUGER PROCESSES IN METALS Ph.D. Thesis
Amy Yi Sang Liu Hagen 1975 107 p
Avail: Univ. Microfilms Order No. 76-17800

The Auger emission spectrum is studied by using a diagrammatic many-body perturbation theory. The plasmon band on the low energy side of the main emission band is obtained by a first order theory. For aluminum, the ratio of the maximum intensity of the plasmon band to that of the parent LVV band is about 40-50 percent. The direct coupling of the plasmon to the outgoing Auger electron is found to play an important role in the calculation in contrast to the case for appearance potential spectroscopy. The Auger decay rates of the 1s level in lithium and 2p level in sodium are studied, and the Auger widths are computed by taking into account orbital relaxation. For Na, the result is consistent with observed X-ray spectra. However, for Li, it is still one order less than would be necessary to explain the broadened edge of soft X-ray spectra. Further studies of mechanisms other than the Auger effect are necessary to explain the Li spectrum. Dissert. Abstr.

N76-31323 Pennsylvania State Univ., University Park.
A STUDY OF ELEVATED TEMPERATURE EFFECT ON BIAXIAL LOW-CYCLE FATIGUE BEHAVIOR OF METALS Ph.D. Thesis
Omer Gunduz Bilir 1975 307 p
Avail: Univ. Microfilms Order No. 76-17146

The effect of elevated temperature and the effect of strain biaxiality ratio on low cycle fatigue behavior of 304 stainless steel specimens were investigated. Experimental results were analyzed by using octahedral shear strain theory. The resulting data was compared with design methods such as the universal slope equation and the 10 percent rule. A concept that relates uniaxial and biaxial fatigue data has been proposed. The proposed method considers the effect of Poisson's ratio. A limited number of torsional strain cycling tests were conducted at 1,200 F to examine the applicability of strain range partitioning method to torsional creep fatigue interaction. Creep shear strain, was superimposed on cycling strain and the resulting inelastic shear strain was partitioned into three components. Each partitioned strain range component was related to the cyclic life of the material. Dissert. Abstr.

N76-31324+ Ugine Aciers, Ugine (France).
LOW CYCLE FATIGUE OF TITANIUM ALLOYS Final Report [ETUDE DE LA FATIGUE OLIGOCYCLIQUE DES ALLIAGES DE TITANE]
B. deGelas and R. Tricot 31 Jul. 1974 38 p refs In FRENCH; ENGLISH summary
(Contract DGRST-72-7-0353)
Avail: NTIS HC $4.00

The low cycle fatigue strength was studied by strain controlled tests on smooth specimens, stress controlled tests on notched specimens, and crack propagation measurements. The effects of metallurgical parameters such as alpha plus beta or beta forging, heat treatment, alloy tensile strength and surface conditions are detailed. ESA

N76-31325+ Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.
THERMOCHEMICAL DEPOSITION ON TITANIUM Final Report [LES DEPOTS THERMOCHIMIQUES SUR LE TITANE]
Pierre Lepetit Dec. 1974 36 p refs In FRENCH
(Contract DGRST-73-7-1565)
Avail: NTIS HC $4.00

A new process is presented to create titanium alloys by thermochemical deposition while eliminating the defects of present day techniques i.e. bad wettability, high friction coefficient, and fretting. The method is based on an exchange reaction between the base metal and a metallic halogenide. The choice of halogenides for Ti and Ti alloys is discussed together with operating conditions. The preparation methods are detailed with regards to Ag, Ni, and Cu deposits. The respective advantages of these coatings are determined. Brazing conditions are detailed together with various types of brazings used. The elongation resistance

of brazed welds was tested. The aptitude of thermochemical coatings to receive electrolytic or chemical coatings is dealt with, having regard to adhesion and friction properties. ESA

N76-31326+ Ugine Aciers, Ugine (France).
CORROSION RESISTANCE OF TITANIUM AND TITANIUM ALLOYS USED IN BOUNDARY CONDITIONS Final Report [RESISTANCE A LA CORROSION DU TITANE ET DE SES ALLIAGES UTILISES DANS DES CONDITIONS MARGINALES]
D. Charquet, B. deGelas, M. Armand, and R. Tricot Mar. 1975 42 p refs In FRENCH
(Contract DGRST-73-7-1566)
Avail: NTIS HC $4.00

The behavior of Ti and titanium alloys in HNO3, HCl, and NaCl was investigated. In the 0.68% HNO3, the titanium is highly resistant to corrosion up to 76 C; however, the corrosion speed of Ti was found higher than 0.12 mm/n in the 25% to 55% concentration range. This is due to high corrosion in condensed vapors from 65% to 67% solutions. The operational conditions, sample surface, conditions of surface finishing, and test durations are important parameters. A cyclic phenomenon: oxide layer growth - peeling of corrosion products was evidenced. In the HCl the corrosion resistance is a function of the structure of the metal, i.e., the thermal treatments in the alpha + beta structure (even if this latter is due to impurities) were found the most sensitive. The influence of the structure explains the localized çorrosion appearing in the vicinity of welded joints. In the NaCl solutions, the cavitation corrosion of pure Ti appears from 150 C. The 1.5 NiTi alloys and, in particular, the 0.2 PdTi alloys are highly resistant to cavitation corrosion. ESA

N76-31327+ Creusot-Loire, Paris (France). Centre de Recherches d'Unieux.
STRESS CORROSION TESTS OF STAINLESS STEELS Final Report [ETUDE DES TESTS DE CORROSION SOUS CONTRAINTE DES ACIERS INOXYDABLES]
Michel Colombie Dec. 1974 29 p refs In FRENCH
(Contract DGRST-73-7-0342)
Avail: NTIS HC $4.00

Tests were carried out in MgCl2 and NaCl solutions of various concentrations, in a 60% CaCl2 solution, and in a 60% LiCl solution. The influence of oxygen was also investigated. Austenitic, ferritic, and austeno-ferritic stainless steels of various concentrations and structures were used as test specimens. Two types of tests for the study of stress corrosion were carried out; they included tensile tests in concentrated solutions of MgCl2, CaCl2, and LiCl at room temperature and four point bending tests in autoclaves at 200 C. ESA

N76-31328*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF ALLOYING WITH NIOBIUM, RHENIUM, AND OSMIUM ON THE PHYSICAL PROPERTIES OF CAST TUNGSTEN
Ye. M. Savitskiy, ed., V. N. Bykov, K. B. Povarova, L. I. Alekseyeva, S. S. Budagovskiy, P. V. Makarov, and I. G. Kondakhchan Washington NASA Sep. 1976 9 p refs Transl. into ENGLISH from the book "Splavy Redkikh Metallov s Osobymi Fiziko-Khimicheskikh Svoystvami" Moscow, Nauka Press, 1975 p 158-161
(Contract NASw-2790)
(NASA-TT-F-17211) Avail: NTIS HC $3.50 CSCL 11F

The magnetic susceptibility and electrical resistivity at 77 K, hardness, and lattice parameter of tungsten-based alloys containing up to 30 at. percent Re, Nb, and 10 at. percent Os are studied. Possible mechanisms accounting for the effect of alloying substitutional elements on the physical properties of cast tungsten are discussed. It is shown that for identical electron concentrations, there occur anomalous changes in the properties considered, which are sensitive to electron configuration and structure. These changes cannot be explained on the basis of known phase diagrams for tungsten-transition metal systems. Author

N76-31329*# TRW Systems Group, Redondo Beach, Calif.
EXPERIMENTAL DEVELOPMENT OF PROCESSES TO PRODUCE HOMOGENIZED ALLOYS OF IMMISCIBLE METALS, PHASE 3
J. L. Reger Aug. 1976 53 p refs
(Contract NAS8-27805)
(NASA-CR-149977) Avail: NTIS HC $4.50 CSCL 11F

An experimental drop tower package was designed and built for use in a drop tower. This effort consisted of a thermal analysis, container/heater fabrication, and assembly of an expulsion device for rapid quenching of heated specimens during low gravity conditions. Six gallium bismuth specimens with compositions in the immiscibility region (50 a/o of each element) were processed in the experimental package: four during low gravity conditions and two under a one gravity environment. One of the one gravity processed specimens did not have telemetry data and was subsequently deleted for analysis since the processing conditions were not known. Metallurgical, Hall effect, resistivity, and superconductivity examinations were performed on the five specimens. Examination of the specimens showed that the gallium was dispersed in the bismuth. The low gravity processed specimens showed a relatively uniform distribution of gallium, with particle sizes of 1 micrometer or less, in contrast to the one gravity control specimen. Comparison of the cooling rates of the dropped specimens versus microstructure indicated that low cooling rates are more desirable. Author

N76-31330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-LAYER THERMAL BARRIER COATING FOR TURBINE AIRFOILS - FURNACE AND BURNER RIG TEST RESULTS
Stephan Stecura Washington Sep. 1976 20 p refs
(NASA-TM-X-3425; E-8767) Avail: NTIS HC $3.50 CSCL 11C

A simple, two-layer plasma-sprayed thermal barrier coating system was developed which has the potential for protecting high temperature air-cooled gas turbine components. Of those coatings initially examined, the most promising system consisted of a Ni-16Cr-6Al-0.6Y (in wt%) thermal barrier coating (about 0.005 to 0.010 cm thick) and a ZrO2-12Y2O3 (in wt%) thermal barrier coating (about 0.025 to 0.064 cm thick). This thermal barrier substantially lowered the metal temperature of an air-cooled airfoil. The coating withstood 3,200 cycles (80 sec at 1,280 C surface temperature) and 275 cycles (1 hr at 1,490 C surface temperature) without cracking or spalling. No separation of the thermal barrier from the bond coating or the bond coating from the substrate was observed. Author

N76-31331*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
CORRELATION BETWEEN FATIGUE LIMITS (S SUB RB, S SUB TC, S SUB AT) AND THE STATIC MECHANICAL PROPERTIES (S SUB u, S SUB y, S SUB yb, TAU SUB y) IN CASE OF HEAT TREATED LOW ALLOY STEELS
J. Friedmann and A. Buch Apr. 1976 17 p refs
(TAE-276) Avail: NTIS HC $3.50

The linear correlation between the fatigue limits in bending, torsion and tension compression and the ultimate tensile strength and other static strength properties was analyzed for a large group of heat treated low alloy steels. Correlation formulas were received for these steels. Author

N76-31332*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SULFIDATION OF 310 STAINLESS STEEL AT SULFUR POTENTIALS ENCOUNTERED IN COAL CONVERSION SYSTEMS
D. Bhogeswara Rao and Howard G. Nelson Sep. 1976 30 p refs Sponsored in part by ERDA
(NASA-TM-X-73166; A-6723) Avail: NTIS HC $4.00 CSCL 11F

The sulfidation of SAE 310 stainless steel was carried out in gas mixtures of hydrogen and hydrogen sulfide over a range of sulfur potentials anticipated in advanced coal gasification processes. The kinetics, composition, and morphology of sulfide scale formation were studied at a fixed temperature of 1,065 K over a range of sulfur potentials from .00015 Nm to the -2nd power to 900 Nm to the -2nd power. At all sulfur potentials investigated, the sulfide scales were found to be multilayered. The relative thickness of the individual layers as well as the composition was found to depend on the sulfur potential. The reaction was found to obey the parabolic rate law after an initial

transient period. Considerably longer transient periods were found to be due to unsteady state conditions resulting from compositional variations in the spinel layer. The sulfur pressure dependence on the parabolic rate constant was found to best fit the equation K sub p equals const. (P sub S2) to the 1/nth power, where n equals 3.7. The growth of the outer layers was found to be primarily due to the diffusion of metal ions, iron being the predominant species. The inner layer growth was due to the dissociation of the primary product at the alloy scale interface and depended on the activity of chromium. Author

N76-31333# Idaho National Engineering Lab., Idaho Falls.
REVIEW OF THE PHYSICAL METALLURGY OF ALLOY 718
D. D. Keiser and H. L. Brown Feb. 1976 27 p refs
(Contract E(10-1)-1375)
(ANCR-1292) Avail: NTIS HC $4.00

The physical metallurgy of Alloy 718 is updated to 1976 on the basis of a survey of post-1967 literature and current experimental data. Composition, microstructures, and mechanical properties are correlated with heat treatment parameters. The current state of understanding of phase stability, strengthening mechanisms, deformation modes, recovery, and recrystallization in this material is described. NSA

N76-31334# Battelle Pacific Northwest Labs., Richland, Wash.
PREPARATION AND CHARACTERIZATION OF THICK METASTABLE SPUTTER DEPOSITS
R. P. Allen, S. D. Dahlgren, and M. D. Merz 1975 9 p refs Presented at 2d Intern. Conf. on Rapidly Quenched Metals, Cambridge, Mass., 17 Nov. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5447; Conf-751172-2) Avail: NTIS HC $3.50

High-rate dc supported-discharge sputtering techniques were developed and used to prepare 0.1 mm to 5.0 mm-thick deposits of a variety of metastable materials including amorphous alloys representing more than 15 different rare-earth-transition metal systems and a wide range of compositions and deposition conditions. The ability to prepare thick, homogeneous deposits has made it possible for the first time to investigate the structure, properties, and annealing behavior of these unique sputtered alloys using neutron diffraction, ultrasonic, and other experimental techniques that are difficult or impractical for thin films. More importantly, these characterization studies show that the structure and properties of the massive sputter deposits are independent of thickness and can be reproduced from deposit to deposit.
Author (NSA)

N76-31335# Tennessee Univ., Knoxville.
STUDIES ON MICROSTRUCTURE-PROPERTY RELATIONSHIPS IN AUSTENITIC STAINLESS STEELS Progress Report, 1 Jan. - 31 Dec. 1975
J. E. Spruiell 1976 36 p refs
(Contract AT(40-1)-4044)
(ORO-4044-6) Avail: NTIS HC $4.00

Results of studies on microstructural stability of stainless steels are summarized. Reported are: Time temperature precipitation in 316 and 321 stainless steels; phase formation in austenitic stainless steels; corrosion behavior of austenitic stainless steels and weld metals; and cold work and recovery in austenitic stainless steels. NSA

N76-31336# Battelle Pacific Northwest Labs., Richland, Wash.
SOLUBILITY AND STABILITY OF LIQUID-QUENCHED METASTABLE hcp SOLID SOLUTIONS
R. Wang 1975 9 p refs Presented at 2d Intern. Conf. on Rapidly Quenched Metals, Cambridge, Mass., 17 Nov. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5603; Conf-751172-1) Avail: NTIS HC $3.50

It is shown that simple crystal chemistry rules may be applied to interpret and predict the solubility limit and phase stability of alloys at nonequilibrium conditions. Twenty-nine liquid-quenched metastable hcp solid solutions containing elements with both bcc and hcp allotropic forms were studied. Hcp solid solutions of Group III elements with Ti, Zr, and Hf obtained by splat cooling showed that the metastable solubility limits were semiquantitatively correlated to the sore factors and c/a ratios. TEM studies indicated that the extended solubilities result from trapping of extra solute in the alpha martensite matrices during L yields beta yeilds alpha transformation. Hcp intra-rare earth solid solutions were controlled by the structural metastability, e.g. these hcp phases were all terminated at c/a ratios near 1.597. Thus, the linear correlation of the c/a deviation from ideality and phase stability proposed by Hodges was demonstrated. Author (NSA)

N76-31337# Battelle Pacific Northwest Labs., Richland, Wash.
METASTABLE A-15 PHASE SUPERCONDUCTORS TRANSFORMED FROM METASTABLE BCC Nb3X SOLID SOLUTIONS MADE BY HIGH-RATE SPUTTER DEPOSITION
R. Wang and S. D. Dahlgren 1975 8 p refs Presented at 2d Intern. Conf. on Rapidly Quenched Metals, Cambridge, Mass., 17 Nov. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5445; Conf-751172-3) Avail: NTIS HC $3.50

In the course of synthesis of superconductive alloys up to 1 mm thick by high-rate sputter deposition, metastable bcc phases of Nb3Al, Nb3Sn, Nb3Ge, Nb3(AlGe), and Nb3Si were obtained. The phase transformation of metastable bcc solid solutions by heat treatment is reported. The grain sizes of the as-deposited bcc phases depended on deposition temperature. For depositions made at approximately 10 C, large variations of grain size were observed among the materials, e.g. approximately 1,000 A for Nb3Al and Nb3Sn, approximately 50 A for Nb3Ge, Nb3(AlGe), and Nb3Si. All bcc phases transformed to the A-15 phase at approximately 650 C within 24 hours except for Nb3Si, which transformed into a tetragonal phase at approximately 750 C. The grain size of the A-15 phase was approximately three to five times the initial grain size of the bcc phase. The phase transformations in Nb3(AlGe) and Nb3Si were described by tentative time-temperature-transformation diagrams.
Author (NSA)

N76-31338# Energy Research and Development Administration, Washington, D.C.
ELECTRIC AND MAGNETIC PROPERTIES OF TRANSITION METALS AND THEIR COMPOUNDS
1 Feb. 1976 44 p refs
(Contract AT(04-3)-34)
(UCR-34P77-47) Avail: NTIS HC $4.00

Results of studies on the electric and magnetic properties of transition metals and their compounds are presented in sections on rare earth metals, rare earth compounds, and transport properties of IrO2, RuO2, and related materials. NSA

N76-31339# Arizona State Univ., Tempe.
STUDY OF FERRITE FORMATION IN NEUTRON IRRADIATED AUSTENITIC STAINLESS STEELS Progress Report, 1 Mar. 1975 - 29 Feb. 1976
J. T. Stanley and L. E. Hendrickson 1976 21 p refs
(Contract AT(11-1)-2317)
(COO-2317-4) Avail: NTIS HC $3.50

Magnetization measurements were carried out on a number of neutron-irradiated austenitic stainless steel specimens. Variation of magnetization with field indicates that the magnetic phase particles are very small so that the particles show superparamagnetic behavior. The temperature dependence of the magnetization indicates that more than one ferromagnetic phase may be present in some of the specimens. Postirradiation annealing at 500 C increased the quantity of magnetic phase in specimens that had been irradiated at 425 C, and annealing in a magnetic field of 33 kOe has the effect of increasing the total quantity of magnetic phase but reducing the average size of the magnetic particles.
Author (NSA)

N76-31340# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
VACUUM FATIGUE FRACTURE OF Ti-6Al-4V
R. J. H. Wanhill and H. Doeker Feb. 1975 26 p refs Prepared jointly with DFVLR, Cologne
(NLR-MP-75006-U) Avail: NTIS HC $4.00

The fractography of structure-sensitive and structure-insensitive vacuum fatigue in fine grained Ti-6Al-4V was investigated using both scanning electron microscopy and transmission electron microscopy of replicas. It is shown that structure-sensitive fatigue of fine grained Ti-6Al-4V in vacuum takes place principally by basal or near-basal cleavage. It is

likely that the cleavage is essentially noncyclic, and mechanically rather than environmentally induced. The structure-sensitive to structure-insensitive transition correspond with a cyclic plastic zone size intermediate between the minor and major dimensions of the elongated alpha grains. Cyclic crack growth was detached for structure-insensitive fatigue, as reported by others.
Author (ESA)

N76-31341# National Gas Turbine Establishment, Pyestock (England).
THE EFFECTS OF SALT AND CARBON PARTICLES ON THE EROSION AND CORROSION BEHAVIOUR OF GAS TURBINE MATERIALS
J. E. Restall Nov. 1975 38 p refs
(NGTE-R-339; BR50445) Avail: NTIS HC $4.00

Turbine rotor blades withdrawn from aero and marine gas turbine engines were subjected to metallurgical examination. In some cases the leading edges of the blades exhibited symptoms of an erosion/wear problem rather than failure by the anticipated sulphidation-corrosion processes. Electron metallographic examination revealed the presence of graphite, quartz, and salt particles in varying amounts on blades withdrawn from any engine. Erosion tests were performed using a whirling-arm rig at room temperature and an air-blast apparatus operating in the range from 813 to 873 K. A ballistic impact apparatus was also used to implant small particles of graphite and salt in the surface of laboratory test pieces at high temperature. Ingested quartz particles less than 5 micrometers in size may induce erosion damage in the turbine section of small engines. Graphite produced in the combustion chamber and dried sea-salt produce both erosion and subsequent chemical degradation at hot blade surfaces. Carbon particles detected at the base of craters or corrosion warts on blades appear to be responsible for producing this mode of corrosion damage. Author (ESA)

N76-31342# European Space Agency, Paris (France).
SLIP DISTRIBUTION AND MECHANICAL PROPERTIES OF METALLIC MATERIALS
G. Luetjering Feb. 1976 133 p refs Transl. into ENGLISH of "Gleitverteilung u. mech. Eigenschaften metallischer Werkstoffe', DFVLR, Porz, West Ger. Report DLR-FB-74-70, 4 Nov. 1974 Original German report available form DFVLR, Porz, West Ger. DM 54.80
(ESA-TT-245; DLR-FB-74-70) Avail: NTIS HC $6.00

The mechanical properties of metallic materials were investigated as a function of the microscopic slip distribution during the plastic deformation of these materials. The main disclosure of the investigation was that the mechanical properties of materials exhibiting an inhomogeneous slip distribution are generally substantially inferior to those of corresponding materials with a homogeneous slip distribution. The various reasons for the inhomogeneous slip distribution are outlined, together with possible ways of changing the slip character of these materials. The different mechanisms of crack nucleation and crack propagation are discussed in particular detail as a function of the different slip modes. Author (ESA)

N76-31343# Oak Ridge National Lab., Tenn.
COATINGS APPLICATIONS FOR FUSION RESEARCH
J. E. Simpkins 1976 17 p refs Presented at the Intern. Conf. on Metallurgical Coatings, San Francisco, 5 Apr. 1976
(CONF-760415-1) Avail: NTIS HC $3.50

A large stainless steel toroidal inner vacuum liner, with a major radius of 79.5 cm and minor radius of 23.5 cm, has been coated with gold to minimize gas adsorption and to provide an inert surface for the plasma in ORMAK, a fusion experiment. A thin platinum film, deposited prior to the gold coating, acts as a diffusion barrier and prevents many of the constituents of the steel substrate from diffusing through the gold to the surface. In a fusion reactor the walls exposed to the plasma will be bombarded by highly energetic neutrals, and a gold surface may not be suitable because of its relatively high sputtering yield. Several other materials, some of which may be more suitable for use as a first wall surface than gold, are identified, but many of these candidates are expected to be impractical to use in their bulk form. A solution is a composite wall consisting of a suitable coating on a substrate chosen for its strength and ease of fabrication. The techniques employed to deposit several of these candidate materials onto stainless steel substrates as thick coatings are described. NSA

N76-31344# Naval Civil Engineering Lab., Port Hueneme, Calif.
CORROSION OF METALS AND ALLOYS IN THE DEEP OCEAN Final Report, Oct. 1961 - Jun. 1974
Fred M. Reinhart Feb. 1976 271 p
(AD-A021279; CEL-TR-834) Avail: NTIS CSCL 11/6

Between 1960 and 1970, about 20,000 specimens of 475 alloys were exposed in the seawater in the Pacific Ocean in order to conduct a program on the effects of deep-ocean environments on materials. The test specimens included steels, cast irons, stainless steels, copper, nickel, aluminum, titanium, miscellaneous alloys, and wire ropes. They were exposed at the surface and at nominal depths of 2,500 and 6,000 feet for periods of time varying from 123 to 1,064 days. The results of their corrosion behavior have been compiled, analyzed, and evaluated in the report. GRA

N76-31345# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
FREQUENCY DEPENDENT DIELECTRIC PROPERTIES OF LEAD-TIN-TELLURIDE Final Report, 1 Apr. 1974 - 31 Dec. 1975
W. E. Tennant and J. A. Cape 27 Feb. 1976 19 p refs
(Contract N00014-74-C-0311; NR Proj. 372-030)
(AD-A022122; SC590.12FR) Avail: NTIS CSCL 20/3

The use of a new impedance matching technique to obtain values of the low frequency dielectric parameters for PbTe by far infrared reflectivity is reported. The values obtained for the transverse optical phonon were 31.3 + or - .3/cm at room temperature and 22.8 + or - .1/cm at liquid nitrogen temperature. The phonon linewidth decreased from 10.8 + or - .7/cm at room temperature to 2.1 + or - .2/cm at liquid nitrogen temperature. The values obtained did not depend strongly on other fit parameters such as plasma frequency or scale factor due to aligning errors. Conventional reflectance measurements were made on a Pb.8Sn.2Te film on PbTe. However, the values obtained for optical mode frequency had large uncertainty due to the strong interdependence of optical mode frequency and scale factor. This report also summarizes the results of earlier work on this contract. Author (GRA)

N76-31346# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept. (SI)
THE CORROSION CONTROL OF FASTENING SYSTEMS FOR AIRCRAFT CARRIER STEAM CATAPULTS Final Report, 5 Apr. 1973 - 3 Jan. 1975
Edward Taylor 31 Mar. 1976 130 p refs
(Contract N00156-73-C-0852)
(AD-A023488; NAEC-ENG-7868) Avail: NTIS CSCL 13/8

Various coating systems were evaluated by short term screening tests and long term environmental tests. These coating systems were selected for applicability on threaded fasteners for an aircraft carrier deck environment not exceeding 200 F. Additional coating systems and a corrosion resistant alloy were similarly evaluated for applicability at 700 F for steam pipe flange fasteners. The results of the overall program strongly indicate the desirability of thick protective coatings (greater than 0.5 mil), elastic sealants, and corrosion resistant alloys. Additionally, some design changes in existing hardware are recommended in order to minimize corrodent entry and accumulation. Author (GRA)

N76-31347# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept. (SI)
INHIBITION OF CORROSION IN CATAPULT WATER BRAKE TANKS Final Report
George A. Gehring, Jr. 28 Jan. 1976 76 p refs
(AD-A022981; NAEC-ENG-7878) Avail: NTIS CSCL 13/4

A study was made to determine the feasibility of using sodium nitrite as a corrosion inhibitor in catapult water brake tanks. The initial study yielded favorable results, therefore follow-up work was initiated to gather additional laboratory data as well as evaluate the sodium nitrite inhibitor on an operational aircraft carrier. The laboratory study included testing under simulated conditions to determine methods for reducing crevice corrosion, characterize stress corrosion susceptibility, and optimize inhibitor treatment. GRA

N76-31348# Army Materials and Mechanics Research Center, Watertown, Mass.
WARM EXTRUSION OF TRIP STEELS Final Report
Roger A. Gagne, Morris Azrin, and James R. Douglas Jan. 1976 18 p Presented at the Midwest Engineering Conf., Milwaukee, Wis., 21-23 Oct. 1975
(DA Proj. 1T1-62105-AH-84)
(AD-A022710; AMMRC-TR-76-2) Avail: NTIS CSCL 13/8

TRIP steel rods were warm extruded to reductions of area of 40%, 60%, and 80%. Temperature increases on the order of 300 F were compensated for by selecting a lower initial billet temperature than the optimum of 850 F used for warm rolling. The billet preheat temperature was selected to produce a maximum extrusion temperature (at the die exit) of 850 F. The 40% and 60% reductions were each performed in one extrusion pass. The 80% reduction required a two-step sequence (60% followed by 50%). This procedure was necessary to avoid the excessively low preheat temperature required for a single reduction to 80%. The extrusion constants are approximately 50 ksi for hot extrusion, 150 ksi for single-pass warm extrusion, and 300 ksi for the second (50%) warm reduction. With the procedures established, the material was successfully extruded to hardness levels equivalent to those obtained by warm rolling. Author (GRA)

N76-31349# IIT Research Inst., Chicago, Ill.
RESEARCH ON COATINGS OR SURFACE TREATMENT OF METAL POWDERS Semiannual Technical Report, 1 Jun. - 30 Nov. 1975
Madhav B. Ranade 15 Dec. 1975 36 p refs
(Contract F19628-75-C-0186; AF Proj. 5620)
(AD-A022679; AFCRL-TR-76-0039; SATR-1) Avail: NTIS CSCL 07/4

Simultaneous effort was directed towards understanding the forces holding the particles, surface treatments, polymer coating, and release properties of metal power. Several alternative treatments are shown feasible for deagglomeration of the aluminum powder. GRA

N76-32100 European Space Agency, Paris (France).
MICROFRACTOGRAPHY OF LOW-CYCLE FATIGUE RUPTURE SURFACES OF A NICKEL ALLOY AND TWO TITANIUM ALLOYS
Georges Vidal, Herve Duriez et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 33-46 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 213-222 (For availability see N76-32097 22-99)

N76-32115 European Space Agency, Paris (France).
FABRICATION BY POWDER METALLURGY OF HEAT-RESISTANT SUPERALLOYS
Andre Hivert, Andre Walder, and Michel Marty *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 91-103 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 359-367 (For availability see N76-32110 22-99)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-31350 California Inst. of Tech., Pasadena.
VISCOELASTIC BEHAVIOR OF FILLED AND UNFILLED ELASTOMERS IN MODERATELY LARGE DEFORMATIONS Ph.D. Thesis
Ricardo Bloch 1976 178 p
Avail: Univ. Microfilms Order No. 76-19571

A constitutive model was developed to describe the viscoelastic (time-dependent) behavior of soft rubberlike materials in moderately large deformations. The model assumes that time shift invariance is preserved in such deformations. Hence, time-dependent behavior can be described by incorporating a nonlinear stress-strain law. An elastic potential based on a generalized measure of strain is used for this purpose. A slightly plasticized styrene-butadiene copolymer rubber (SBR) was subjected to various modes of deformation in simple tension. The experimental data agreed well with theoretical predictions. It was also discovered that emulsion polymerized compression molded dicumylperoxide cured SBR showed a lack of time shift invariance in the region of very small strains in which elastomers generally follow a linear stress-strain law. Finally, to test the applicability of the model to filled elastomers, crosslinked and uncrosslinked SBR filled with a high-structure carbon black were studied. Dissert. Abstr.

N76-31351+ Centre National de la Recherche Scientifique, Bellevue (France). Lab. de Physique des Materiaux.
INVESTIGATION OF THE SUPERFICIAL AUTODIFFUSION OF SIMPLE CERAMICS BY STUDYING IN-SITU THE SURFACE MICROTOPOGRAPHY Final Report [ETUDE DE L'AUTODIFFUSION SUPERFICIELLE DES CERAMIQUES SIMPLES PAR L'ETUDE DE LA MICROTOPOGRAPHIE IN-SITU DE LA SURFACE]
J. Philibert Oct. 1974 7 p In FRENCH
(Contract DGRST-71-7-2780)
Avail: NTIS HC $3.50

In order to investigate the surface diffusion of ceramics, studying 'in situ' the evolution of the topography of a surface heated in the ultra vacuum, a laser interferometer was developed. Its operational principles are presented. The finishing of sample surfaces using the technique of photo-engraving is described. Experimental results using polycrystalline nickel as sample and the new laser interferometer for studying the surface transport phenomenon are presented and discussed. Future work on simple ceramics is suggested. ESA

N76-31352# Bendix Corp., Kansas City, Mo.
FEASIBILITY STUDY FOR PRODUCING HIGH-DENSITY POLYSTYRENE BEAD FOAM
R. C. Swoboda Jan. 1976 28 p refs revised
(Contract AT(29-1)-613)
(BDX-613-1422-Rev) Avail: NTIS HC $4.00

It was determined that the production of high-density polystyrene bead foam (PSBF) within a density range of 0.20 to 0.50 g/cu cm is feasible, using existing production equipment. The required processes were developed for steam pre-expansion, pneumatogen depletion, and molding to yield material with acceptable density uniformity. The mechanical properties for foam at selected density levels were determined. Author (ERA)

N76-31353# Addis Translations International, Woodside, Calif.
PROPERTIES OF RIGID POLYURETHANE FOAMS OF MICROPOROUS STRUCTURE
R. Ostrysz, P. Penczek, and J. Skrzewiecki Mar. 1974 12 p refs Transl. into ENGLISH from Polimery (Poland), v. 18, 1973 p 299-302 Sponsored by ERDA Prepared for Lawrence Livermore Lab.
(UCRL-Trans-10739) Avail: NTIS HC $3.50

The mechanical properties of polyurethane foams were investigated. It was found that the apparent density of polyurethane foams decreases with increasing amount of water in the starting mixture. The compressive and impact strengths increase with increasing apparent density; the water absorption and high-temperature shrinkage are also increased. The introduction of the polyesterol Poles 50/23 (with greater molecular weight and smaller branching) in place of part of the polyesterol Poles 210/24 causes an appreciable increase in the impact strength of a simultaneous fall of compressive strength. A considerable decrease of compressive strength occurs when the addition of polyesterol Poles 50/23 exceeds 15%, and such additions are therefore undesirable. A side effect of increasing the elasticity with an unchanged content of water, catalysts, and foaming regulator in the starting mixture is a decrease in the apparent density; the water absorption and the shrinkage at elevated temperatures remain practically unchanged. Author (ERA)

N76-31354# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
INVESTIGATION OF MASS LOSS RATE AND INTERNAL TEMPERATURE DEVELOPMENT OF SIMPLE CYLINDRICAL ABLATING BODIES

Knud Kindler 25 Mar. 1976 104 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-23) Avail: NTIS HC $5.50; DFVLR, Cologne DM 38.60

Experimental and numerical results on the ablation of polytetrafluoroethylene are presented. The experimental data were obtained in the air flow of an arc heated wind tunnel. The main purpose of the one-dimensional unsteady calculations is the consideration of the influence of the boundary condition on the ablation process. In particular, the effect of the optical transparency of the amorphous part was investigated. Experiments and numerical results are found in good agreement.

Author (ESA)

N76-31355# Union Carbide Corp., Tarrytown, N.Y. Corporate Research Lab.
FORMULATIONS OF META-CARBORANE-SILOXANES
E. N. Peters, D. D. Stewart, J. J. Bohan, G. T. Kwiatkowski, C. D. Beard, R. Moffitt, and E. Hedaya 4 Dec. 1975 28 p refs
(Contract N00014-72-C-0277; NR Proj. 356-525)
(AD-A021260; CRL-T-828) Avail: NTIS CSCL 11/10

D2-meta-carborane-siloxane polymers have been developed for ultrahigh temperature elastomer applications. In particular, these materials have outstanding thermal stability in addition to fire and chemical resistance. Basic studies relating to resin-filler interactions, polymer structure, peroxide and extending fillers on thermal stability have been carried out. The optimization studies have afforded valuable information leading to both improvements in long term aging stability and fabrication characteristics. The use of hydrophobic silica as a reinforcing agent instead of a fumed silica resulted in substantial improvements in retention of properties after aging. Furthermore the use of high molecular weight stock and lower peroxide levels for curing has led to a system with outstanding retention of properties after heat aging in air at 315C. These unique high performance capabilities are being confirmed in sealant, gasket, O-ring, and coating applications. GRA

N76-31356# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THERMALLY INDUCED MIGRATION OF APIEZON C. THE EFFECTS OF VACUUM AND SURFACE FINISH Interim Report
Robert A. Slade, Alfred A. Fote, and Seymour Feuerstein 17 Mar. 1976 32 p refs
(Contract F04701-75-C-0076)
(AD-A023089; TR-0076(6270-30)-6; SAMSO-TR-76-57) Avail: NTIS CSCL 07/4

An investigation of the surface migration of thin films of Apiezon C on metal substrates has been undertaken. The study was initiated in order to determine the effect of temperature gradients on the distribution of lubricants in spacecraft mechanical assemblies. The results of experiments performed in air were described earlier. It was verified that the effect observed at that time is also present under vacuum conditions. The important role played by surface finishes was demonstrated.

GRA

N76-31357# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
FREON T-WD 602 TEMPERATURE CONSIDERATIONS WHEN CLEANING PRECISION MEASUREMENT EQUIPMENT Final Report, Mar. 1974 - May 1975
Norman E. Williams Feb. 1976 47 p refs
(AD-A023192; AFAL-TR-76-21) Avail: NTIS CSCL 13/8

The purpose of this investigation was to determine the correct operating temperature of 'FREON' T-WD 602, when it is used as a solvent in an ultrasonic cleaner to clean PME. In order to determine the correct operating temperature of the 'FREON' T-WD 602 it was first necessary to develop a method of making dirt samples that were uniform. The cleaning efficiency of the 'FREON' T-WD 602 was established for various temperatures.

Author (GRA)

N76-31358# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
VARIABILITY OF CUSHIONING PROPERTIES OF POLYURETHANE FOAMS Final Report
Richard V. Brown Mar. 1976 19 p
(AD-A022461; DSPT-76-8) Avail: NTIS CSCL 13/4

The primary objective of this study was to determine the variability in the dynamic cushioning properties of flexible polyurethane foam materials procured from different sources under the requirements of MIL-P-0026514C. A secondary objective was to establish the degree of correlation between the dynamic cushioning properties of polyurethane foam and various material physical properties such as density, static stress characteristics and Indent Load Deflection (ILD) factor. The results of this study show that there is considerable variability in the dynamic cushioning properties of polyurethane foam materials. There appears to be some correlation between dynamic cushioning characteristics and material properties such as ILD, average stress, and static energy absorption, but no correlation with density.

Author (GRA)

N76-31359# United Technologies Corp., East Hartford, Conn.
PROCESS DEVELOPMENT FOR PRESSURELESS SINTERING OF SiAl ON CERAMICS COMPONENTS Final Rept. Jan. 1975 - Jan. 1976
George K. Layden 3 Jan. 1976 83 p refs
(Contract N00019-75-C-0232)
(AD-A022696; UTRC/R75-912072-4) Avail: NTIS CSCL 21/5

Phase equilibrium was studied in the system Si3N4-AlN-Al2O3-SiO2. A broad two phase field of liquids in equilibrium with Beta SiAlON solid solutions was found to exist at temperatures above about 1750 C. Initial studies were undertaken to exploit this two phase field to effect a homogeneous transient liquid phase sintering of Beta compositions. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N76-31360# European Space Agency, Paris (France).
IGNITION BEHAVIOR OF AVIATION FUELS AND SOME HYDROCARBONS Ph.D. Thesis, Munich Technical Univ.
Friedrich Koerber Apr. 1976 66 p refs Transl. into ENGLISH of "Ueber das Zuendverhalten von Flugkraftstoffen u. einigen Kohlenwasserstoffen einheitlicher Zusammensetzung"; DFVLR, Munich Report DLR-FB-75-67, 20 Oct. 1975 Original German report available from DFVLR, Cologne DM 26.30
(ESA-TT-289; DLR-FB-75-67) Avail: NTIS HC $4.50

The relighting of jet engines in flight makes an important contribution to operational safety in aviation. Reignition is influenced by both engine design and fuel properties. The processes that occur during the ignition of diffusion flames were investigated, paying special attention to the fuel properties. An extensive series of tests of the ignition behavior of aviation fuels and hydrocarbons of homogeneous composition in a simplified model combustion chamber are reported. The air inlet conditions were 200 to 800 mbar and 300 to 500 K. The maximum air inlet velocity at which each fuel could still be ignited by means of an electric spark just downstream of the flame holder was used as a measure of the ignitability of the fuel. The correlation between the physical and chemical properties and the ignitability of the fuels is discussed. Author (ESA)

N76-31361# Vanderbilt Univ., Nashville, Tenn. Dept. of Engineering Science.
THREE-DIMENSIONAL ACOUSTIC ANALYSIS OF SOLID ROCKET MOTOR CAVITIES
Robert M. Hackett Nov. 1975 128 p refs
(Contract DAHC04-72-A-0001; DA Proj. 1M3-62303-A-214)
(AD-A020380; RK-TR-76-7) Avail: NTIS CSCL 21/9

The basis for a three-dimensional finite element acoustic analysis computer code to be used on the combustion instability analysis of solid rocket motor cavities is formulated. The analogy between the development of the structural element and the fluid element and utilization of structural codes for fluid dynamics

analyses is demonstrated. The employment of the concept of dihedral symmetry and the coupling of the behavior of fluid and structural elements are important features of the formulation.
GRA

N76-31362# Frankford Arsenal, Philadelphia, Pa.
ALTERNATE SOLVENTS FOR BENZENE IN NITROCELLULOSE RECOVERY
Joel M. Goldman and Joseph A. Sipia, Jr. Aug. 1975 28 p refs
(AD-A023111; FA-TR-75064) Avail: NTIS CSCL 19/1

This study represents one portion of a program directed toward the minimization or elimination of toxicity and flammability hazards associated with the use of benzene in the recovery of nitrocellulose from surplus single base cannon propellants in the manufacture of ball propellants. It is shown that dichloromethane can replace the current benzene-ethyl acetate cosolvent in nitrocellulose recovery operations while maintaining extraction efficiency, minimizing toxicity dangers, eliminating a fire hazard, simplifying solvent handling, shortening processing time, and reducing energy requirements. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-31363 Duke Univ., Durham, N.C.
PRESSURE STUDIES AND PULSED NMR STUDIES IN SOLID HYDROGEN Ph.D. Thesis
Robert Francis Buzerak 1976 243 p
Avail: Univ. Microfilms Order No. 76-18944

A presentation is made of two studies made on solid hydrogen. In the first study the ortho-para conversion rate was studied at 4.2 K up to a relative density of p/p sub o = 1.2, where p sub o is the density at zero pressure. In the second study, the longitudinal relaxation time, T1, and the transverse relaxation time, T2, were studied in low concentration (less than 20% ortho) hydrogen between .4 K and 13.6 K at 5MHz and 29MHz under saturated vapor pressure. The ortho-para conversion rate measurements under pressure were prompted by a prediction that the conversion rate may go through a minimum in the cross over region between the one and two-phonon processes. A high pressure gas handling system capable of reaching 20,000 psi was used to check this prediction. Dissert. Abstr.

N76-31364 Pennsylvania State Univ., University Park.
DESIGN OF OPTIMAL DIGITAL CONTROLS FOR POWER SYSTEMS Ph.D. Thesis
Andrew Hargrove 1975 160 p
Avail: Univ. Microfilms Order No. 76-17173

The investigation is concerned with adopting a suitable mathematical model of a power system, examining and adjusting a proper iterative procedure for finding an extremum of a nonlinear functional of several variables that are required to satisfy certain constraints, and finally applying this numerical procedure to the power system model as an algorithm. The end result is the design of a multipurpose digital controller that will accept any initial state and minimize a cost functional of the system. The power system model adopted is based on the concept of state, uses a vector-matrix representation, and is well suited for the application of modern control theory. The gradient projection method of Rosen is examined and from it an algorithm developed. The validity of the gradient method, the machine model and the algorithm are demonstrated in the simulation of a single machine via a digital computer. Adaptability of the algorithm to a variety of optimal control problems is verified. Dissert. Abstr.

N76-31365* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTEGRATED STRUCTURE VACUUM TUBE Patent
John Dimeff and William J. Kerwin, inventors (to NASA) Issued 31 Aug. 1976 8 p Filed 24 Jul. 1974 Supersedes N74-29577 (12 - 19, p 2258)
(NASA-Case-ARC-10445-1; US-Patent-3,978,364; US-Patent-Appl-SN-491418; US-Patent-Class-313-306; US-Patent-Class-313-250; US-Patent-Class-313-309; US-Patent-Class-313-338) Avail: US Patent Office CSCL 14B

High efficiency, multi-dimensional thin film vacuum tubes suitable for use in high temperature, high radiation environments are described. The tubes are fabricated by placing thin film electrode members in selected arrays on facing interior wall surfaces of an alumina substrate envelope. Cathode members are formed using thin films of triple carbonate. The photoresist used in photolithography aids in activation of the cathodes by carbonizing and reacting with the reduced carbonates when heated in vacuum during forming. The finely powdered triple carbonate is mixed with the photoresist used to delineate the cathode locations in the conventional solid state photolithographic manner. Anode and grid members are formed using thin films of refractory metal. Electron flow in the tubes is between grid elements from cathode to anode as in a conventional three-dimensional tube.
Official Gazette of the U.S. Patent Office

N76-31366# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
SIMPLE CALCULATION OF MILL CUTTING CONDITIONS USING A NOMOGRAM [CALCUL SIMPLE DES CONDITIONS DE COUPE EN FRAISAGE A L'AIDE D'UN NOMOGRAMME]
Willy DuMong and Marc Dieperinck Feb. 1976 33 p refs In FRENCH
(CRIF-NT-12) Avail: NTIS HC $4.00

A simplified theory of milling is presented specifying the simplifications required to produce a nomograph whereby the cutting conditions are found from the milling machine horsepower and torque. The programming for the nomograph was performed on a HP 65 pocket calculator. ESA

N76-31367# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
AN EASIER METHOD TO PROGRAM BORING MACHINES WITH NUMERICAL CONTROL [UNE FACON DE PROGRAMMER PLUS FACILEMENT LESS ALESEUSES A COMMANDE NUMERIQUE]
Philippe Gaudissart and Luc Soete Mar. 1976 18 p In FRENCH
(CRIF-NT-13) Avail: NTIS HC $3.50

An illustration is given of the simplification introduced in programming numerically controlled boring machines by using the EXAPT 1.1 machine oriented language. The convenience of the language for choice of coordinates, selection of tools, and velocities is detailed. ESA

N76-31368# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
METHODS OF SOIL STABILIZATION FOR EROSION CONTROL Final Report
Sidney Diamond Oct. 1975 62 p refs Sponsored by the Federal Highway Administration, Washington D. C., and Indiana State Highway Commission, Indianapolis
(PB-252922/0; JHRP-75-20) Avail: NTIS HC $4.50 CSCL 13B

The possible application of inexpensive soil stabilization treatments for the purpose of reducing or preventing soil erosion on construction sites and consequent downstream sediment problems was investigated. Treatments were evaluated by measuring erosion loss of treated soil specimens exposed to a severe standardized rainfall test sequence. Treatments investigated included modest percentages of portland cement, hydrated lime, or waste cement plant dust incorporated with the soil by mixing and compaction, or by application in slurry form over the surface of previously compacted specimens. GRA

N76-31369# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BIBLIOGRAPHY OF RANN-SUPPORTED FIRE RESEARCH LITERATURE, JULY 1970 - JUNE 1975. TOPICAL REPORT
B. W. Kuvshinoff and J. B. Jernigan Feb. 1976 145 p
(Grant NSF GI-44088)
(PB-252960/0; APPL/JHU-FPP-TR-20; NSF/RA/E-75-039) Avail: NTIS HC $6.00 CSCL 13L

The entries in this bibliography represent the formal fire research documentation produced at 20 institutions under NSF RANN sponsorship. This includes journal articles, symposium and conference papers, technical reports, theses and dissertations, and motion picture film. Progress reports, talks, and informal memoranda are not included. Entries are arranged alphabetically by author under these general headings for each institution. A list of prinicpal investigators and their affiliations is included as an appendix. The entries are all numbered in parentheses following the principal author. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-31370 British Broadcasting Corp., Kingswood (England). Dept. of Research.
EXPERIMENTAL DIGITAL TRANSMISSION OF MULTIPLEXED VIDEO AND AUDIO SIGNALS AT 120 MBIT/S
D. W. Osborne Jun. 1976 10 p refs
(BBC-RD-1976/16) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

During 1975, field trials were carried out in which 120 Mbit/s signals, generated by equipment specially constructed in BBC Research Department, were transmitted over a UK Post Office experimental high-speed digital line system. Multiplexed video and audio signals were sent from Portsmouth to Guildford and back, from Portsmouth to Southampton and back, and also through both of these circuits in tandem. An outline of the experimental equipment is given. No serious difficulties arose in the trials but several interesting facts which emerged are discussed, mainly concerning error performance and timing jitter. Author

N76-31371 British Broadcasting Corp., Kingswood (England). Dept. of Research.
THE WAVE-TILT METHOD OF MEASURING GROUND CONSTANTS IN THE L F AND M F BANDS
J. L. Eaton Jun. 1976 6 p refs
(BBC-RD-1976/15; UDC-621.396.673) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The theory of the wave tilt method of determining ground constants (conductivity and permittivity) at l.f. and m.f. is outlined and the limitations of the theory in practice are discussed. Typical instrumentation for conducting wave tilt measurements is mentioned and the effect of measurement errors assessed. Author

N76-31372* National Aeronautics and Space Administration. Pasadena Office, Calif.
REAL TIME ANALYSIS OF VOICED SOUNDS Patent
Jung P. Hong, inventor (to NASA) (JPL) Issued 31 Aug. 1976 9 p Filed 11 Dec. 1974 Supersedes N75-13593 (13 - 04, p0465) Sponsored by NASA
(NASA-Case-NPO-13465-1; US-Patent-3,978,287; US-Patent-Appl-SN-531575; US-Patent-Class-179-1SA) Avail: US Patent Office CSCL 17B

A power spectrum analysis of the harmonic content of a voiced sound signal is conducted in real time by phase-lock-loop tracking of the fundamental frequency, (f sub 0) of the signal and successive harmonics (h sub 1 through h sub n) of the fundamental frequency. The analysis also includes measuring the quadrature power and phase of each frequency tracked, differentiating the power measurements of the harmonics in adjacent pairs, and analyzing successive differentials to determine peak power points in the power spectrum for display or use in analysis of voiced sound, such as for voice recognition. Official Gazette of the U.S. Patent Office

N76-31373*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ULTRA STABLE FREQUENCY DISTRIBUTION SYSTEM Patent Application
Richard L. Sydnor (JPL) and John W. MacConnell, inventors (to NASA) (JPL) Filed 21 Jun. 1976 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13836-1; US-Patent-Appl-SN-699002) Avail: NTIS HC $3.50 CSCL 17B

The frequency distribution system of the present invention can be utilized for distributing a frequency standard to remotely located land based or satellite stations. A signal is synchronized at a remotely located slave station with the phase and frequency of a signal generated at a master station. The signal transmitted at the master station and received by the slave station provides compensation for the phase shift caused by the transmission path delays between the master and slave station. The slave station transmits a signal to the master station at a frequency that is different from the frequency of the signal being transmitted by the master station. The signal transmitted by the slave station is received by the master station while the master station transmitter is off. The signal transmitted by the master station is received by the slave station while the slave station transmitter is off. NASA

N76-31374*# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
RENDEZVOUS RADAR MODIFICATION AND EVALUATION Final Report
1 Oct. 1976 45 p
(Contract NAS9-14865)
(NASA-CR-147879) Avail: NTIS HC $4.00 CSCL 17I

The purpose of this effort was to continue the implementation and evaluation of the changes necessary to add the non-cooperative mode capability with frequency diversity and a doppler filter bank to the Apollo Rendezvous Radar while retaining the cooperative mode capability. Author

N76-31375*# Axiomatix, Marina del Rey, Calif.
INTEGRATED SOURCE AND CHANNEL ENCODED DIGITAL COMMUNICATION SYSTEM DESIGN STUDY Final Report
Gaylord K. Huth 31 Jul. 1976 200 p refs
(Contract NAS9-13467)
(NASA-CR-147880; R7607-3) Avail: NTIS HC $7.50 CSCL 17B

The results of several studies Space Shuttle communication system are summarized. These tasks can be divided into the following categories: (1) phase multiplexing for two- and three-channel data transmission, (2) effects of phase noise on the performance of coherent communication links, (3) analysis of command system performance, (4) error correcting code tradeoffs, (5) signal detection and angular search procedure for the shuttle Ku-band communication system, and (6) false lock performance of Costas loop receivers. Author

N76-31376*# Stanford Telecommunications, Inc., Mountain View, Calif.
HIGH RATE BIT SYNCHRONIZER Final Report
Richard F. Lyon 16 Apr. 1976 37 p
(Contract NAS9-14590)
(NASA-CR-147881; STI-TR-4166) Avail: NTIS HC $4.00 CSCL 17B

This report documents the analysis and experimental validation of the performance of various aspects of a high rate bit synchronizer. Author

N76-31377*# TRW Systems Group, Redondo Beach, Calif.
SIGNAL DESIGN STUDY FOR SHUTTLE/TDRSS KU-BAND UPLINK Final Report, 1 Dec. 1975 - 1 Sep. 1976
Aug. 1976 208 p refs
(Contract NAS9-14842)
(NASA-CR-150919; TRW-29210) Avail: NTIS HC $7.75 CSCL 17B

The adequacy of the signal design approach chosen for the TDRSS/orbiter uplink was evaluated. Critical functions and/or components associated with the baseline design were identified, and design alternatives were developed for those areas considered high risk. A detailed set of RF and signal processing performance specifications for the orbiter hardware associated with the TDRSS/orbiter Ku band uplink was analyzed. Performances of a detailed design of the PN despreader, the PSK carrier synchronization loop, and the symbol synchronizer are identified. The

performance of the downlink signal by means of computer simulation to obtain a realistic determination of bit error rate degradations was studied. The three channel PM downlink signal was detailed by means of analysis and computer simulation.
S.M.

N76-31378*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT (SITE): REPORTS FROM THE NASA RESIDENT REPRESENTATIVE IN INDIA
Howard L. Galloway, Jr. May 1976 89 p
(NASA-TM-X-74146) Avail: NTIS HC $5.00 CSCL 17B
Reports submitted by the NASA project representative for the Satellite Instructional Television Experiment (SITE) at Ahmedabad, India are presented. These reports deal with the coordination of all SITE related matters between the ATS 6 Project at Goddard Space Flight Center, NASA Headquarters, and the SITE Program in India. Author

N76-31379# Communications Research Centre, Ottawa (Ontario).
AN AIRBORNE LINEAR-SWEEP FM RADAR SYSTEM FOR MEASURING ICE THICKNESS
G. O. Venier and F. R. Cross Dec. 1975 32 p refs
(CRC-1269) Avail: NTIS HC $4.00
The design is described of a high resolution radar for use in measuring fresh-water ice thickness from a helicopter. The feasibility of ice-thickness measurement with an FM radar of this type was proved. Of particular concern is the data acquisition system required to record ice-thickness information at two meter intervals when the aircraft is moving at a speed of about 80 miles/h. The radar difference-frequency signal is sampled, converted to digital form and recorded on computer-compatible magnetic tape along with a time reference. The spectral analysis necessary to extract the depth information is accomplished on the ground by means of a Fast Fourier Transform routine in a digital computer. The equipment was designed for quick installation on a helicopter. Author

N76-31380# Standard Electrik Lorenz A.G., Stuttgart (West Germany).
DATA COMPRESSION AND ERROR CORRECTING METHODS FOR SIGNAL TRANSMISSION [STUDIEN UND UNTERSUCHUNGEN ZUR SIGNALUEBERTRAGUNG, INSBESONDERE ZUR DATENKOMPRESSION UND DATENSICHERUNG]
Siegfried Nestel and Klaus Paehlig Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 180 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-2070; GfW-RV-11-06/21/70)
(BMFT-FB-W-75-29) Avail: NTIS HC $7.50; ZLDI, Munich DM 37,80
The quantile system, adaptive predictors, and convolutional codes are discussed. The quantile system and the adaptive predictor can be applied to data compression of telemetry signals, whereas convolutional codes are used for correcting transmission errors. For the quantile system, the influence of a limited number of processed stochastic telemetry data on the variance of the transmitted quantiles is shown, as well as the influence of a limited number of transmitted quantiles on the reconstruction error of the probability distribution function of the data. Methods for realizing a linear adaptive predictor are compared. An iterative method, according to the principle of steepest descent of the mean squared error, showed good convergence properties. The predictor was tested on a computer using simulated stochastic processes. The most important methods of decoding convolutional codes are presented and the advantages and disadvantages of these techniques summarized. Burst-error-correcting convolutional codes are described. Author (ESA)

N76-31381# Heimann G.m.b.H., Wiesbaden (West Germany).
TELEVISION CAMERA TUBES FOR X-RAYS Final Report [FERNSEHKAMERAROEHREN FUER ROENTGENSTRAHLUNG]
Walter Heimann, Claus Kunze, and Ullrich Traupe Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 105 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-28) Avail: NTIS HC $5.50; ZLDI, Munich DM 22,05
The intrinsic X-ray photoeffect of semiconducting layers can be used for the conversion of the invisible radiation image into a video signal. Various materials were examined and selenium with 2% as added proved to be the most effective. The negative image appearing after exposure which could not be completely eliminated was suppressed by a combination of a Sb2S3-vidicon tube with a fiber optic face plate and a fluorescent screen. A television system was developed for the pick-up of pulsed, low intensity X-ray images. This proved very useful for nondestructive testing. Author (ESA)

N76-31382# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
THE TIME AND FREQUENCY DOMAIN ANALYSIS OF LUMPED AND LOSSLESS DISTRIBUTED NETWORKS
Matti Ilmonen 1976 10 p refs Sponsored by the Acad. of Finland
(Rept-S-86; ISBN-951-750-678-3) Avail: NTIS HC $3.50
The state variable method is well known in the analysis of lumped, linear active networks in the frequency and time domain. Transmission lines cannot be handled directly because the state of the transmission line is a function of both time and place. However, the model for lossless transmission lines can be formulated in such a form that the normal differential equation set turns into two different sets, namely the differential equation set and the difference equation set. These new equations can then be solved in the time domain by ordinary routines, when the input is known as a function of time. The transfer function in the frequency domain can be calculated, if the input is a step function, using the fast Fourier transform. Author (ESA)

N76-31383# Culler/Harrison, Inc., Goleta, Calif.
NETWORK VOICE CONFERENCE. SPEECH COMPRESSION RESEARCH AT CHI Quarterly Technical Report, Dec. 1975 - Feb. 1976
Michael McCammon and Glen J. Culler Mar. 1976 29 p refs
(Contract DAHC15-73-C-0252; ARPA Order 2359)
(AD-A022907; CHI-QTR-201) Avail: NTIS CSCL 17/2
This report covers the activities of CHI in development of a network voice conferencing system using linear predictive coding for speech data compression from December 1975 through February 1976. The voice conferencing system is an extension of an existing network speech compression system incorporating control messages for speaker selection and data routing, together with transmitting and receiving programs which respond to them. The current implementation of this system at CHI is described. The system monitoring and recording facilities implemented are discussed with examples of their use for analysis of system performance. Author (GRA)

N76-31384# Edaw, Inc., San Francisco, Calif.
SEAFARER SITE SURVEY, NEVADA REGION, BOOK 2 Final Report
22 Dec. 1975 375 p refs Prepared for GTE Sylvania, Inc., Needham Heights, Mass.
(Contract N00039-75-C-0309)
(AD-A021019) Avail: NTIS CSCL 17/2
The objective of the study is to provide a comprehensive environmental data base portraying all physical, biological, and socioeconomic factors that should be considered in assessing the impact of the proposed SEAFARER system on the environment. The data presented will serve two major purposes: (1) a basis for preparation of the Environmental Impact Statement and (2) input for final system design and siting. The Site Area is defined as the area encompassing the Tonopah Test Range, the Nellis Bombing Range, and the Nevada Test Site. It includes approximately 4,256 square miles. The region of interest is generally defined as the four-county region including Clark, Lincoln, Nye, and Esmeralda Counties. The environmental data have been grouped into a series of sixteen distinct data categories. GRA

N76-31385# Edaw, Inc., San Francisco, Calif.
SEAFARER SITE SURVEY, NEW MEXICO REGIONS, BOOK 3 Final Report
22 Dec. 1975 425 p refs Prepared for GTE Sylvania, Inc.,

Needham Heights, Mass.
(Contract N00039-75-C-0309)
(AD-A021020) Avail: NTIS CSCL 17/2

The objective of the study is to provide a comprehensive environmental data base portraying all physical, biological, and socioeconomic factors that should be considered in assessing the impact of the proposed SEAFARER system on the environment. The data presented will serve two major purposes: (1) a basis for preparation of the Environmental Impact Statement, and (2) input for final system design and siting. The Site Area encompasses the White Sands Missile Range and portions of the Fort Bliss Military Reservation. The site includes approximately 4,000 square miles. The region of interest is generally defined as the five-county New Mexico region including Socorro, Lincoln, Sierra, Dona Ana, and Otero Counties, plus the El Paso metropolitan area in western Texas. The environmental data have been grouped into a series of sixteen distinct data categories. GRA

N76-31386# Booz-Allen and Hamilton, Inc., Bethesda, Md.
COMMUNICATIONS SYSTEMS REQUIREMENTS STUDY
18 Jun. 1975 238 p refs
(Contract N00039-75-C-0068)
(AD-A020225) Avail: NTIS CSCL 17/2

The study provides a comprehensive analysis of Marine Corps communications systems requirements and means of satisfying these requirements within the limitations and constraints imposed by the technological, fiscal, and operational environment. The impact of future automated command and control, digitized secure voice and high speed data transmission requirements on Marine Corps communications equipment, systems, and concepts, as determined by this study, is an important input to communications planning efforts and the development of new equipment. GRA

N76-31387# Booz-Allen and Hamilton, Inc., Bethesda, Md.
COMMUNICATIONS SYSTEMS REQUIREMENTS METHODOLOGY
12 May 1975 173 p refs
(Contract N00039-75-C-0068)
(AD-A020224) Avail: NTIS CSCL 17/2

The object was to conduct a Communications Systems Requirements (CSR) Study and develop a CSR Methodology for subsequent maintenance and update of the study by Marine Corps personnel. The CSR Methodology contains approaches for data collection and analysis, requirements determination, system concept definition, and requirements monitoring and update. Execution of procedures outlined in this document will enable Marine Corps communications requirements and R and D planning to be kept current. GRA

N76-31388# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH A RECTANGULAR APERTURE IN A PERFECTLY CONDUCTING PLANE Interim Report
J. R. Mautz and Roger F. Harrington Feb. 1976 49 p refs
(Contract F19628-73-C-0047; AF Proj. 5635)
(AD-A022685; Scientific-10; AFCRL-TR-76-0056) Avail: NTIS CSCL 20/14

A computer program is developed for calculating the transmission characteristics of a rectangular aperture in a perfectly conducting plane excited by an incident plane wave. The solution is obtained from the integral equation for the equivalent magnetic current using the method of moments. The expansion functions and testing functions are pulses in the direction transverse to current flow, and triangles in the direction of current flow. Quantities computed are the equivalent magnetic current and the transmission cross section patterns. To illustrate the solution, computations are given for narrow slots and for square apertures. The computer program is described and listed with sample input-output data. Author

N76-31389# Coast Guard, Washington, D.C. Electronics Engineering Div.
HIGH VOLTAGE AC POWER TRANSMISSION LINES AND COMMUNICATIONS RECEIVER SITES Technical Note, May 1975 - Mar. 1976
F. R. Hill 26 Mar. 1976 36 p refs
(AD-A022986; EEE-TR-1) Avail: NTIS CSCL 17/2

A short discussion of the effects of the Electromagnetic Interference (EMI) radiated from High Voltage AC (HVAC) Power Transmission lines on HF Communications Receivers is followed by the description of a method for choosing communications receiver sites to minimize interference from these transmission lines. GRA

N76-31390# Stanford Research Inst., Menlo Park, Calif.
MODELING OF TRANSIONOSPHERIC RADIO PROPAGATION Final Technical Report, May 1974 - May 1975
E. J. Fremouw and C. L. Rino Griffiss AFB, N. Y. RADC Feb. 1976 57 p refs
(Contracts F30602-74-C-0279; ARPA Order 2777; AF Proj. 2777)
(AD-A023197; RADC-TR-76-35) Avail: NTIS CSCL 17/2

This is the final quarterly technical report on a one-year contract to extend and improve an existing empirical model for worldwide behavior of ionospherically imposed radio-wave scintillation. The objectives of the project were (1) to improve the accuracy of model-based calculations of the intensity-scintillation index and (2) to develop a capability for full description (from the point of view of engineering applications) of the first-order, complex-signal statistics that characterize the transionospheric radio communication channel. The stated objectives of the just-completed project were accomplished by starting with the scintillation model developed by Fremouw and Rino (1973), adding a geomagnetic-activity dependence for the behavior of scintillation-producing ionospheric irregularities, and substituting a more accurate and general scattering theory for that of Briggs and Parkin (1963) used in the earlier model. The results of these efforts have been implemented in two computer programs. The first, entitled RFMOD, contains the main elements of the scattering theory, the morphological model for ionospheric irregularity strength and other parameters, and subroutines for calculating the geometry and other relevant quantities from user-specified inputs. GRA

N76-31391# University of Southern Calif., Marina del Rey. Information Sciences Inst.
SPECIFICATIONS FOR THE NETWORK VOICE PROTOCOL
Dan Cohen Mar. 1976 40 p refs
(Contracts DAHC15-72-C-0308; ARPA Order 2223)
(AD-A023506; ISI/RR-75-39) Avail: NTIS CSCL 17/2

The Network Voice Protocol (NVP) described in this report was developed by the Network Secure Communications group at ISI at the host-to-host protocol level, since the 'regular' host-to-host protocol was found unsuitable for real-time network voice communication. The report describes in detail the control and data components of the protocol. Appendix 1 defines associated tables, and Appendix 2 presents some implementation recommendations. Author (GRA)

N76-31392# Naval Electronics Lab. Center, San Diego, Calif.
AN/PRC-104 ANTENNA STUDY Final Research and Development Report
J. C. Logan 3 Feb. 1976 50 p refs
(NELC Proj. B816)
(AD-A023283; NELC-TR-1980) Avail: NTIS CSCL 17/2

Analysis of the performance of Radio Set AN/PRC-104 over the range between 2 and 30 MHz was made using several candidate antennas for comparison with the performance of the AN/PRC-104 when its 8-foot antenna was used. No significant difference in performance was noted when the man made skin contact with the antenna. Improved groundwave communications should be possible with the equipment operating at higher frequencies as compared with performance at the lower portion of the 2- to 30-MHz range. Reduction in absorption of energy by the body of the man wearing the packset can be accomplished by setting the packset on the ground and transmitting as a monopole system with the man at least 4 to 5 feet away or by clothing the man with a uniform or suit made of conductive material. GRA

N76-31393# Ohio State Univ. Research Foundation, Columbus.
INFLUENCE OF THE SOLAR ELECTRON ENERGY DISTRIBUTION ON THE MICROWAVE SPECTRUM OF GYROSYNCHROTRON RADIATION Final Report, 1 Oct. 1972 - 30 Sep. 1975

Hsien C. Ko and Chiwei Chuang 13 Feb. 1976 35 p refs
(Contract F19628-73-C-0004; AF Proj. 4643)
(AD-A022977; AFGL-TR-76-0030) Avail: NTIS CSCL 17/2

The volume emissivity formula for gyro-synchrontron radiation from an ensemble of electrons having a power-law energy distribution and an isotropic pitch-angle distribution is presented. Numerical calculations of the radiation spectrum were made for four electron kinetic energy ranges (10 keV 100 keV, 100 keV - 1 MeV, 1 MeV - 10 MeV, and 10 keV - - 10 MeV), and for four values of electron energy spectral index. The influence of electron energy distribution on the radiation spectrum is discussed. Author (GRA)

N76-31394# Aerospace Corp., El Segundo, Calif.
DEMONSTRATION OF A FLEXIBLE REMOTING SYSTEM FOR AFSATCOM TO MEET DIVERSE USER REQUIREMENTS Final Report
J. W. Montgomery and S. L. Strubel 15 Dec. 1975 58 p ref
(Contract F04701-75-C-0076)
(AD-A022897; SAMSO-TR-76-41; TR-0076(6401)-3) Avail: NTIS CSCL 17/2

As part of the RC-135 test program, a demonstration of the AFSATCOM system remoting capability was planned. The remoting system was developed at the Aeropsace Corporation to demonstrate the feasibility of transmitting and receiving message traffic via an AFSATCOM ground terminal remotely from a UYA-7 or UGC-120. It was also desired to demonstrate the feasibility of remote control of the terminal frequency plan, modem channel, and antenna. Although difficulties were experienced during early development of the demonstration remoting system, they were overcome through software modification and the test results show conclusively that the general purpose computer approach is valid. The fact that rapid reprogramming and program modifications could be quickly accomplished to meet schedule deadlines attests to the flexibility and adaptability offered by this approach. Author (GRA)

N76-31395# Defense Communications Engineering Center, Reston, Va.
AN ANALYSIS OF THE FEASIBILITY OF INCREASED DEPENDENCE ON COMMERCIAL COMMUNICATIONS SATELLITES FOR SATISFYING DOD REQUIREMENTS
G. E. LaVean Aug. 1975 123 p refs
(AD-A022451; TN-35-75) Avail: NTIS CSCL 17/2

This report addresses the key issues involved in increasing the usage of and dependence on commercial satellite facilities to satisfy Department of Defense (DoD) communications requirements. The potential cost savings are analyzed and the constraints that are likely to limit the feasibility of fully realizing these savings are investigated. A properly conceived and managed program could result in savings exceeding a hundred million dollars per year compared to the current terrestrial system.
Author (GRA)

N76-31396# Mitre Corp., Bedford, Mass.
ERROR PATTERNS AND BLOCK CODING FOR THE DIGITAL HIGH-SPEED AUTOVON CHANNEL
Kenneth Brayer Feb. 1976 29 p refs
(Contract F19628-75-C-0001; AF Proj. 6190)
(AD-A022489; MTP-160; ESD-TR-75-369) Avail: NTIS CSCL 17/2

Voice telephone systems, such as AUTOVON, are currently being used for the transmission of high-speed digital data. AUTOVON's performance in passing 4,800 b/s and 9,600 b/s digital data via the state-of-the-art Codex 9,600 modem is adequate to support channel bit error rates in the order of 0.0001 to 0.00001. Additionally, it is demonstrated that the errors occur in bursts of lengths and densities such that block coding for error correction would require the use of a large number of parity bits per block (approximately 90% parity for full error correction). Improvement factors of two orders of magnitude in block error rate, at 50% parity, can be achieved. GRA

N76-31397# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SPEECH RECOGNITION SYSTEM TEST. IDENTIFICATION OF VOWELS EXCERPTED FROM ORAL AND NASAL CONTEXTS
Z. S. Bond Jan. 1976 28 p refs
(AF Proj. 7232)
(AD-A022900; AMRL-TR-75-1) Avail: NTIS CSCL 17/2

A set of speech stimuli, consisting of vowels excerpted from context, were constructed in order to evaluate the performance of the speech recognition system under construction in this laboratory. The stimuli were presented to human subjects and to the speech recognition system for identification. It was found that human performance was only slightly superior to the performance of the system on this phonetic classification task.
Author (GRA)

N76-31398# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SYNTACTIC ANALYSIS IN A SPEECH UNDERSTANDING SYSTEM
Madeleine Bates Aug. 1975 266 p refs Prepared in cooperation with Harvard Univ., Cambridge, Mass.
(Contract N00014-75-C-0533; Grant NSF GS-39834; ARPA Order 2904)
(AD-A022559; BBN-3116) Avail: NTIS CSCL 17/2

This report presents a system for syntactic analysis in the context of a computer system for the understanding of spontaneously spoken English. GRA

N76-31399# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
PERFORMANCE ANALYSIS SUMMARY OF FOUR SELECTED CIRCUITS OF THE SAUDI ARABIA NATIONAL GUARD HF RADIO NET Final Report
George Lane and William T. Alvarez Mar. 1976 27 p ref
(AD-A022553; EMEP-76-4) Avail: NTIS CSCL 17/2

A performance analysis summary is made for two alternative high frequency (HF) radio net configurations, termed the primary and back-up system configurations for the Saudi Arabia National Guard. The impact on system performance is computed for changes in transmitter power and type of antennas proposed for the two configurations on four representative paths. A figure of merit is developed for HF circuit performance comparison. A discussion of this comparison technique is presented. GRA

N76-31400# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Sciences.
A USER'S MANUAL FOR OPTICAL WAVEGUIDE COMMUNICATIONS
R. L. Gallawa Mar. 1976 295 p refs
(PB-252901/4; OTR-76-83) Avail: NTIS HC $9.25 CSCL 17B

The manual is addressed to the practicing communicator who is faced with the prospect of understanding and working with the new technology of optical waveguide digital communications. The intent is to introduce this subject via intuitive and non-mathematical notions, insofar as possible. The treatise is self-contained and includes a glossary of terms. The text covers optical sources, detection, the transmission medium (glass fiber waveguides), modulation and multiplexing. The report closes with a consideration of practical system design. The report contains a complete bibliography, by subject matter, but no references. The heavily mathematical subjects are relegated to two appendices. GRA

N76-31401# Department of Transportation, Washington, D.C. R/D Resources Management Div.
STANDARDS FOR THE PREPARATION AND PUBLICATION OF DOT SCIENTIFIC AND TECHNICAL REPORTS
May 1976 25 p
(PB-245400/7; DOT/TST-75/97) Avail: NTIS HC $3.50 CSCL 05B

The document provides standards for the preparation, publication, and distribution of scientific and technical reports issued by DOT and DOT contractors. The standards do not apply to technical or training manuals, journal articles, brochures or pamphlets. The document contains guidelines for report formals, title pages and covers, metric conversions, use of illustrations and physical layout requirements. Report review and acceptance procedures are specified, as are the rules for assignment of document numbers and distribution of accepted reports. GRA

N76-31402# Institute for Telecommunication Sciences, Boulder, Colo.
STATISTICAL FREQUENCY-DISTANCE CURVES, INITIAL MODEL
R. D. Jennings, L. E. Vogler, and J. J. Stephenson Apr. 1976 202 p refs
(PB-252704/2; OTR-76-84) Avail: NTIS HC $7.75 CSCL 17B

A computer program that produces statistical frequency-distance curves is described. The computer program was developed as a tool for use by the frequency managers' community of OTP/IRAC. The statistical frequency-distance curves estimate the minimum distance separation that is required between a victim receiver and an interferer as a function of the frequency offset between them. The model uses statistical variations in antenna gain and propagation loss to compute the probability of interference. Appendices describe the propagation loss and antenna gain models and the method used to combine them to produce the statistical frequency-distance curves. Operating instructions and several sample applications also are included. GRA

N76-31403# Little (Arthur D.), Inc., Cambridge, Mass.
A STUDY OF COMPETITIVE ACQUISITION OF TELECOMMUNICATIONS BY THE FEDERAL GOVERNMENT
May 1976 328 p refs
(Contract TP-5AC015)
(PB-252719/0; OTP-76/005C) Avail: NTIS HC $10.00 CSCL 17B

The following types of telecommunications acquisition activity are analyzed: common user voice circuits and services; dedicated private line voice circuits and services; commercial toll and local telephone service; leased common user data and record circuits and services; dedicated data services and circuits; commercial teletype and other record communications services; and telecommunications equipment procurement lease, installation, operation, and maintenance. GRA

N76-31404# Little (Arthur D.), Inc., Cambridge, Mass.
AN ANALYSIS OF DOMESTIC AND FOREIGN SMALL EARTH STATION MARKETS
John J. Ginty Apr. 1976 173 p refs
(Contract C-5-35628)
(PB-253236/4; OT-CR-76-3) Avail: NTIS HC $6.75 CSCL 17B

Information is given relative to the domestic and foreign markets for small earth station (antenna size 10 meters or less). Descriptions of the subsystems and technology for small earth stations, U.S. manufacturers of earth stations and key technologies, major domestic and nondomestic system specifications, competitive factors for U.S./foreign suppliers, U.S/domestic and foreign small earth station market forecasts, analyses of past INTELSAT earth station sales, legal limitations on cooperative efforts to improve the U.S. competitive position overseas, and recommendations to improve the U.S. import/export trade posture are included. A world listing of existing and proposed earth stations through 1979, and a glossary of terms are also included. GRA

N76-31405# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
NBS TIME AND FREQUENCY DISSEMINATION SERVICES Final Special Publication
Sandra L. Howe Jan. 1976 25 p refs Supersedes NBS-SP-236, COM-73-504-38
(PB-253114/3; NBS-SP-432; NBS-SP-236; COM-73-50438) Avail: NTIS HC $3.50 CSCL 17B

Detailed descriptions are given of the time and frequency dissemination services of the National Bureau of Standards. These services include the broadcasts from radio stations WWV, WWVH, WWVB, and WWVL, and new time and frequency calibration services using television. This publication shows the services available on January 1, 1976. It will be updated only when the services are revised or when new services are added. A list of other publications available about the Time and Frequency Division is also included. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-31406 Virginia Univ., Charlottesville.
POSITIVE TRIMMING AND VOLTAGE COEFFICIENT OF RESISTANCE MEASUREMENT OF THICK FILM RESISTORS Ph.D. Thesis
Frank W. Blake 1976 88 p
Avail: Univ. Microfilms Order No. 76-18090

A new method for decreasing the value of thick film resistors is presented. The method requires the addition of conductive bridges across part of the resistor and thus decreasing its effective length. The electrical characteristics of the positive trimmed resistors are compared with their predicted characteristics and with the characteristics of resistors trimmed by other methods. A new procedure is developed which makes it possible to measure the voltage coefficient of resistance within +1 PPm/V. A new definition of working voltage has been established to produce a constant power dissipation per square inch which produces a constant electric field. The new measuring procedure and consistent definition of working voltage make it possible to establish the effect of length and width on the VCR. The relationship between the change in resistance and the trimmed area has been investigated. Finally, a possible industrial method for positive trimming resistors, using presently available equipment, is presented. Dissert. Abstr.

N76-31407 State Univ. of New York, Stony Brook.
ON THE dc CHARACTERISTICS AND ac SMALL SIGNAL IMPEDANCE ANALYSIS OF BARITT DIODE Ph.D. Thesis
Swei-Yam Yu 1976 85 p
Avail: Univ. Microfilms Order No. 76-18737

The barrier injection transit time (BARITT) diode is known as a low noise microwave generator. Both the dc and ac characteristics are analyzed. The dc characteristics below the reach through condition are derived by applying the majority current continuity condition. It is found that the current near the reach through condition is dominated by either a diffusion current or a generation current depending on the generation time constant. Based on the J-V characteristics, the reach through voltage is defined, the voltage difference between the flat band voltage and reach through voltage is found to be almost a linearly increasing function of device length. By considering a joint probability that a carrier passes over potential barrier and travels a distance before being scattered, the onset of reach through current is derived, and the infinite minority carrier density slope in conventional theory is removed. Dissert. Abstr.

N76-31408 Ohio State Univ., Columbus.
TRANSIENT ANALYSIS OF A SPLIT PHASE INDUCTION MOTOR USED IN A RECIPROCATING COMPRESSOR Ph.D. Thesis
Lazar I. Almasanu 1976 224 p
Avail: Univ. Microfilms Order No. 76-17958

The transient speed build-up of a split-phase induction motor with a compressor load was studied. Equivalent circuits for the motor with and without the auxiliary starting winding were derived by using symmetrical components and Gabriel Kron's generalized machine theory. The resulting dynamical equations were expressed in state-variable notation to facilitate their solution by a digital computer. The compressor load was analyzed from fundamental thermodynamic principles, and a curve of torque versus angular position was derived. Computer programs for calculating transient speed and currents during acceleration from standstill to final speed were written and applied to a typical refrigerator motor-compressor unit. The results compared favorably with experimental observations. Dissert. Abstr.

N76-31409* National Aeronautics and Space Administration. Pasadena Office, Calif.
III-V PHOTOCATHODE WITH NITROGEN DOPING FOR

INCREASED QUANTUM EFFICIENCY Patent
Lawrence William James, inventor (to NASA) (Varian Associates, Palo Alto, Calif.) Issued 31 Aug. 1976 10 p Filed 27 Dec. 1974 Supersedes N75-16745 (13 - 08, p 0878) Sponsored by NASA
(NASA-Case-NPO-12134-1; US-Patent-3,978,360; US-Patent-Appl-SN-536785; US-Patent-Class-313-94; US-Patent-Class-357-63) Avail: US Patent Office CSCL 09C

An increase in the quantum efficiency of a 3-5 photocathode is achieved by doping its semiconductor material with an acceptor and nitrogen, a column-5 isoelectronic element, that introduces a spatially localized energy level just below the conduction band similar to a donor level to which optical transitions can occur. This increases the absorption coefficient, alpha without compensation of the acceptor dopant. A layer of a suitable 1-5, 1-6 or 1-7 compound is included as an activation layer on the electron emission side to lower the work function of the photocathode.
Official Gazette of the U.S. Patent Office

N76-31410* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DUAL MODE SOLID STATE POWER SWITCH Patent
Louis C. Maus (Sperry Rand Corp.) and Donald E. Williams, inventors (to NASA) Issued 31 Aug. 1976 4 p Filed 11 Mar. 1975 Supersedes N75-19536 (13 - 11, P 1238)
(NASA-Case-MFS-22880-1; US-Patent-3,978,350; US-Patent-Appl-SN-557444; US-Patent-Class-307-255; US-Patent-Class-307-300; US-Patent-Class-307-313; US-Patent-Class-307-315) Avail: US Patent Office CSCL 09A

A solid state amplifier has an output transistor stage and an input transistor stage interconnected as a Darlington circuit. An interstage transistor interconnecting the collectors of the two stages of the Darlington circuit is connected with the first stage transistor in a compound configuration. When the load current furnished by the amplifier is less than a predetermined value, the output stage operates as a simple saturated switch with its base drive current flowing through the emitter-base junction of the first stage which produces no collector current because the base-emitter junction of the interstage transistor is reverse-biased. When the load current exceeds said predetermined value, the interstage transistor begins to conduct allowing the input and output stages to operate as a Darlington amplifier and diverting a significant portion of the base drive current of the output transistor back into the load.
Official Gazette of the U.S. Patent Office

N76-31411+ Lignes Telegraphiques et Telephoniques, Conflans-Sainte-Honorine (France). Dept. Hyperfrequence.
THEORETICAL AND EXPERIMENTAL STUDY OF MICROWAVE TRANSMISSION LINES WITH A PHASE/FREQUENCY RELATIONSHIP FOLLOWING A GIVEN VARIATION LAW Final Report [ETUDE THEORIQUE ET EXPERIMENTALE DE LIGNES DE TRANSMISSION HYPERFREQUENCE DONT LA PHASE OBEIT A DES LOIS DETERMINEES DE VARIATION EN FONCTION DE LA FREQUENCE]
B. Chiron and M. Fache 30 Jan. 1975 62 p refs In FRENCH
(Contract DGRST-73-7-1371)
Avail: NTIS HC $4.50

Folded transmission lines were studied with a view to improve the bandwidth of phase shifters of group delay equalizers. The technology used is microwave microelectronics on ceramic substrates and ferrites. The experimental results are compared to an approximate theory and shown to be in fair agreement at least for alumina substrates. The phase shift between variously coupled meanders led to the implementation of phase laws corresponding to a range of practical problems. Phase excursions of plus or minus 5 deg around 180 deg were obtained over one octave in the 2 to 4 GHz range. The implementation on ferrites is shown to require further theoretical work due to the effect of the permeability tensor. ESA

N76-31412+ Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
MOLYBDENUM VAPOR PHASE DEPOSITION FROM MoCl5 Final Report [ETUDE DU DEPOT DE MOLYBDENE EN PHASE VAPEUR A PARTIR DE MoCl5]
M. Croset and M. Colombier Dec. 1974 7 p refs In FRENCH
(Contract DGRST-73-7-1343)
(LCR-083/029) Avail: NTIS HC $3.50

The vapor phase deposition of molybdenum from the pentachloride was studied in order to obtain silicon ohmic contacts. The deposition was accomplished by reduction of MoCl5 by hydrogen in an oven heated by the Joule effect. Normally silicon N type, doped with phosphorus, was justified. The crystallography and the diameter of the deposited particles were analyzed with X-rays. The results are discussed, and it is concluded that the deposition of Mo at low temperature (500 deg) does not seem to be suitable for the production of low resistance silicon ohmic contacts. ESA

N76-31413*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PHASE SUBSTITUTION OF SPARE CONVERTER FOR A FAILED ONE OF PARALLEL PHASE STAGGERED CONVERTERS Patent Application
Gene W. Wester (JPL) and W. T. McLyman, inventors (to NASA) (JPL) Filed 10 Jun. 1976 18 p Sponsored by NASA
(NASA-Case-NPO-13812-1; US-Patent-Appl-SN-694855) Avail: NTIS HC $3.50 CSCL 09C

Failure detection and substitution of a spare module is provided in a system having a plurality of phase staggered modules connected in parallel to deliver regulated voltage from an unregulated source. Phase control signals applied to the active converter modules are applied to the spare module through NOR gates associated with and disabled by the power output of respective active modules. Failure of any one enables its phase control signal to be applied to the spare module, thus controlling the spare module to operate in the phase position of the failed module. A NAND gate detects when any one active module fails and enables a gate in the spare module, thus activating the spare module. NASA

N76-31414# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
USER'S MANUAL CIRCUS 2: CIRCUIT ANALYSIS PROGRAM
J. R. Greenbaum Jul. 1975 174 p
(Doc-75SDR017) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

The CIRCUS-2, a digital computer program for the analysis of electronic networks, is described. Since it is primarily a tool for circuit designers and analysts, the definition of networks and solution procedures is made as straightforward as possible. A user with a background in electronics can describe a problem and indicate his output requirements without any knowledge of digital computers or computing techniques. The printed output includes the input data, steady-state solutions, columnar listings of the network variables vs. time, and plots. Circuit variables may also be saved on a magnetic tape for subsequent input to other circuits or further analysis by other programs. Author

N76-31415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE STUDIES OF THERMIONIC CATHODES AND THE MECHANISM OF OPERATION OF AN IMPREGNATED TUNGSTEN CATHODE
Ralph Forman Washington Sep. 1976 31 p refs
(NASA-TN-D-8295; E-8515) Avail: NTIS HC $4.00 CSCL 07D

The surface properties of conventional impregnated cathodes were investigated by the use of Auger spectroscopy and work function measurements, and these were compared with a synthesized barium or barium oxide coated tungsten surface. The barium and barium oxide coated surfaces were prepared by evaporating barium onto a tungsten surface that can be heated to elevated temperatures. Multilayer or monolayer coverages can be investigated using this technique. The results of this study show that the surface of an impregnated tungsten cathode is

identical to that observed for a synthesized monolayer or partial monolayer of barium on partially oxidized tungsten, using the criteria of identical Auger patterns and work functions. Desorption measurements of barium from a tungsten surface were also made. These results in conjunction with Auger and work function data were interpreted to show that throughout most of its life an impregnated cathode operating in the range of 1100 C has a partial monolayer rather than a monolayer of barium on its surface. Author

N76-31416# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER-AIDED DESIGN OF SEPARABLE TWO-DIMENSIONAL DIGITAL FILTERS
R. E. Twogood and S. K. Mitra 31 Oct. 1975 8 p refs
Presented at 9th Ann. Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 3 Nov. 1975
(UCRL-77271; Conf-751109-10) Avail: NTIS HC $3.50

The computation involved in both the filter design and implementation is shown to be efficient. Several examples are presented which illustrate the application of the technique. Author (ERA)

N76-31417# Bendix Corp., Kansas City, Mo.
ELECTRICAL CONDUCTIVITY STUDY OF ETCHED-OUT PLATED-THROUGH HOLES IN DOUBLE-SIDED PRINTED WIRING BOARDS
R. J. Setter Jan. 1976 23 p
(Contract AT(29-1)-613)
(BDX-613-1434; PDO-6984684) Avail: NTIS HC $4.00

A proposed method for producing nonplated-through holes in double-sided printed wiring boards is proved not detrimental to the functioning of the boards. Electrical conductivity measurements of holes which are drilled, plated through with copper, and subsequently etched out to produce nonplated-through holes indicated negligible conductance in the range from 1 to 6 pieomhos 1 to 6 pS. Author (ERA)

N76-31418# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
DEVELOPMENT OF IMPATT DIODES [ENTWICKLUNG VON LAWINENLAUFZEITDIODEN]
Guenter Kesel and Juergen Hammerschmitt Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 25 p ref In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-1072; GfW-RV-11-TH-3/72-Z)
(BMFT-FB-W-75-31) Avail: NTIS HC $3.50; ZLDI, Munich DM 5,25

The development of IMPATT diodes in the frequency range 10 to 15 GHz and some work in the 40 GHz region is described. The following results were achieved: (1) IMPATT diodes with more than 100 mW P sub 0 operating at 10 to 14 GHz in a single mesa construction, (2) IMPATT diodes with more than 650 mW P sub 0 operating at 14 GHz in a double mesa technology. Some preliminary work was done in the 40 GHz region; samples reaching 7 mW P sub 0 between 30 and 40 GHz were made. These low power values are due to a nonideal epitaxy with two smooth doping steps. A silane reactor was built which will be used in conjunction with ion implantation techniques to improve diode performance at microwave frequencies. Author (ESA)

N76-31419# AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.
AUDIO FREQUENCY CIRCUITS FOR AVERAGE OUTPUT POWER Final Report [NF-SCHALTUNGEN FUER MITTLERE AUSGANGSLEISTUNGEN]
Dieter Herchner and Kurt Hintzmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 44 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-40) Avail: NTIS HC $4.00; ZLDI, Munich DM 9,25

The development of integrated circuits with high output power capability high supply voltage, and suitable for economic fabrication is described. The circuits can be used for a wide range of supply voltage, offer high reliability of operation, and require a small number of peripheral components. The extensive specifications of the electric parameters allow the application for general purposes even in the commercial sector. The evaluation shows that the requirements were met. Author (ESA)

N76-31420# Physics Lab. RVO-TNO, The Hague (Netherlands).
AN EXPERIMENTAL STUDY OF A LATCHED NON-RECIPROCAL FERRITE PHASE SHIFTER AT S-BAND
A. VanArdenne Aug. 1975 43 p refs
(Contract A71/KM/107)
(PhL-1975-22; TDCK-66723) Avail: NTIS HC $4.00

Experimental results of measurements on a nonreciprocal S-band latched ferrite phase shifter for phased array radar antennas are presented. Some geometrical parameters were adjusted in such a way that a fairly optimized phase shifter results. Two types of ferrite material were examined. For one type of ferrite, considerable losses below 2.8 GHz were found; it can, however, be applied at frequencies higher than about 3 GHz. For the other type of ferrite, the figure of merit is less, and the peak power threshold is lower by about 30% in comparison with the first type. Because of this, it is concluded that for a center frequency of 3 GHz, a ferrite of the first type should be applied with a 10% lower saturation magnetization than used in these experiments. Author (ESA)

N76-31421# Physics Lab. RVO-TNO, The Hague (Netherlands).
ARRAY SIMULATORS
J. Snieder Aug. 1975 63 p refs
(Contracts A71/KM/106; A71/KM/107)
(PhL-1975-30; TDCK-66722) Avail: NTIS HC $4.50

Mismatch for certain scan angles of an infinitely large array antenna with uniform energy distribution can be determined by means of a small waveguide structure, the simulator. The operation of the simulator is explained. A complete derivation is given of the equation for the discrete scan angles of various types of simulators. Some simulators were built and tested. Good agreement was found between experiment and theory. Further experience has to be obtained with the more complex simulators. A waveguide simulator was built for a scan angle where complete compensation for mutual coupling has to be applied. The size and position was determined of the matching of the compensation for mutual coupling of an experimental planar phased array antenna, using the simulator. Author (ESA)

N76-31422# Physics Lab. RVO-TNO, The Hague (Netherlands).
AN EXPERIMENTAL STUDY OF A LATCHED NON-RECIPROCAL FERRITE PHASE SHIFTER AT X-BAND
A. VanArdenne Dec. 1975 56 p refs
(Contract A71/KM/107)
(PhL-1975-50; TDCK-67200) Avail: NTIS HC $4.50

Experimental results of measurements on a nonreciprocal X-band latched ferrite phase shifter for phased array radar antennas are presented. Some geometrical parameters were adjusted in such a way that a fairly optimized phase shifter results. Some aspects of this phase shifter were compared with the theoretical results of a modified twin slab model. Two types of ferrite material were examined. The Mg Mn-type has a rather poor temperature performance and a low peak power threshold. Better temperature performance and a much higher peak power threshold (about 20 times) were obtained with a temperature compensated garnet with a lower 4 pi Ms value. The figure of merit of the phase shifter with a ferrite diameter with optimum temperature performance is about 500-600 C/dB. Due to the lower 4 pi Ms value, about 50% more garnet material is needed for the same saturation differential phase as the Mg Mn ferrite. Author (ESA)

N76-31423# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE EFFECT OF MUTUAL COUPLING AT THE FEEDING SIDE OF A LARGE, PLANAR, SPACEFED PHASED-ARRAY ANTENNA WITH A LOW (FOCAL DISTANCE) DIAMETER RATIO
H. J. VanSchaik Dec. 1975 24 p refs
(Contract A71/KM/106)
(PhL-1975-51; TDCK-67194) Avail: NTIS HC $3.50

A special problem connected with the use of a space feed for a large planar phased-array antenna with a low F/D ratio (F = focal distance, D = diameter) is dealt with. This problem concerns the determination of the losses due to mutual coupling occurring at the feeding side of the antenna and arriving from

the free-space propagation of the wave emitted by the primary feed. This mutual coupling depends on the frequency and the geometrical dimensions of the antenna. A method is presented to determine the reflection factor of each element at the feeding side of the antenna. The effect of an internal match for mutual coupling at the feeding side of the Caissa-antenna is investigated. From the results it can be concluded that with respect to the feeding side of the antenna, the losses due to mutual coupling in case of no match can be quite considerable for some elements. Further it is concluded that the presence of an internal match at the feeding side reduces the losses. Author (ESA)

N76-31424# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.

THE RELATION BETWEEN SIGNAL FLOW MATRICES AND STATE MATRICES OF TIME-DISCREET SYSTEMS [UEBER DEN ZUSAMMENHANG ZWISCHEN SIGNALFLUSSMATRIZEN UND ZUSTANDSMATRIZEN ZEITDISKRETER SYSTEME]

Raimund Luecker Feb. 1976 15 p refs In GERMAN
(IND-FB-83) Avail: NTIS HC $3.50

Time discrete systems, consisting of multipliers, multiple adders, and delay circuits, are described by signal flow matrices for well chosen internal parameters. The state matrices were calculated from these by matrix operations. A method was developed to determine the realization of state matrices by consequent inversion of these computational steps. ESA

N76-31425# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Elektroakustik.

THE EQUIVALENT SURFACE SPACE CHARGES SIGMA 1 AND SIGMA 2 OF A ONE-DIMENSIONAL SPACE CHARGE ELECTRET AS A FUNCTION OF THE POSITIVE AND NEGATIVE TOTAL CHARGES AND THEIR CENTERS OF GRAVITY [DIE AEQUIVALENTEN OBERFLAECHENLADUNGEN SIGMA 1 UND SIGMA 2 EINES EINDIMENSIONALEN RAUMLADUNGS-ELEKTRETEN ALS FUNKTION DER POSITIVEN UND DER NEGATIVEN GESAMTLADUNGEN UND DEREN SCHWERPUNKTE]

Guenter Morgenstern Feb. 1976 9 p refs In GERMAN
(IND-FB-84) Avail: NTIS HC $3.50

The integral equations for equivalent surface space charges Sigma 1 and Sigma 2 introduced by G. M. Sessler for a space charge electret are represented by positive and negative total charge and their centers of gravity. ESA

N76-31426# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Elektroakustik.

CALCULATION OF THE FORCE ON AN ELECTRET IN THE ELECTRET-SLOT CONVERTER USING THE ENERGY PRINCIPLE [DIE BERECHNUNG DER KRAFT AUF EINEN ELEKTRETEN IM ELEKTRETSCHLITZWANDLER MIT HILFE DES ENERGIEPRINZIPS]

Guenter Morgenstern Mar. 1976 10 p refs In GERMAN
(IND-FB-85) Avail: NTIS HC $3.50

The force attracting an electret into an electric field of a capacitor and the force acting on an electret in an electret-slot converter are calculated using the energy principle; results are compared with those from previous publications. ESA

N76-31427# Danish Research Center for Applied Electronics, Hoersholm.

TANTALUM CAPACITORS. AN EVALUATION OF ELEVEN TYPES OF TANTALUM CAPACITORS

A. Bjerre and K. Skaanning Apr. 1975 40 p Partly sponsored by Sammenslutningen for Paalideligheds-og Miljoetek.
(ECR-38) Avail: NTIS HC $4.00

The stability of different tantalum capacitors available on the Danish market is compared. A 35 V capacitor in a high and low capacity value was tested for each manufacturer. Particular emphasis was placed on the long term stability when exposed to humidity conditions and to load life test at high temperatures. For some of the manufacturers tested, many catastrophic failures occured. The test results are given in a graphical form, enabling an easy comparison between the different manufacturers. Author (ESA)

N76-31428# Danish Research Center for Applied Electronics, Hoersholm.

PLASTIC CAPACITORS. A COMPARATIVE INVESTIGATION OF THE QUALITY AND STABILITY OF 31 MANUFACTURES AND TYPES, INCLUDING 5 DIFFERENT DIELECTRICS

U. Fabricius Jan. 1975 58 p Transl. into ENGLISH of Danish report ECR-41 Sponsored by Sammenslutningen for Paalideligheds- og Miljoetek. and by Teknologiraadet
(ECR-49) Avail: NTIS HC $4.50

Thirty-one types of capacitors distributed over 14 different manufactures and representing the various existing kinds of dielectrics, including both the metallized and foiled types were tested. An AC and DC-life test at max. temperature were included as a part of the climatic environment exposures to examine a possible difference in the stability of the capacitors in the two different kinds of life tests. The test showed that several of the capacitors manage an AC-life test better than a DC-life test. A pulse test of the capacitors with a dV/dt of a max. of 700 V/microsec showed a great dispersion among and within the various manufactures and as expected the foiled types proved in general to manage better than the metallized types. Author (ESA)

N76-31429# Danish Research Center for Applied Electronics, Hoersholm.

MICROWAVE INTEGRATED CIRCUIT PROCESS INVESTIGATION. WORK PACKAGE 1: DEVICE MOUNTING USING CONDUCTIVE EPOXIES Final Report

E. Sletten and Poul Villien 15 Dec. 1975 153 p 3 Vol.
(Contract ESTEC-2338/74-AK)
(ESA-CR(P)-819-Vol-1) Avail: NTIS HC $6.75

The feasibility of fabricating Microwave Integrated Circuits (MIC) for satellite application using hybrid technology was studied. Schottky barrier diodes and ceramic chip capacitors were mounted on a two component low temperature curing epoxy or on a one component high temperature curing epoxy. The devices were mounted on a NiCr/Au thin film pattern or an alumina substrate. Thermal shock, temperature storage, chip mounting strength, vibration, and constant acceleration tests were made. After each test step the characteristic quantities of the devices were measured. It is concluded that, under certain conditions, mechanically reliable Schottky barrier diodes can be mounted with Elecolite 325, and extremely reliable mountings of chip capacitors can be performed if Epo-tek M40 is used. ESA

N76-31430# Danish Research Center for Applied Electronics, Hoersholm.

MICROWAVE INTEGRATED CIRCUIT PROCESS INVESTIGATION. WORK PACKAGE 2: HERMETIC SEALING Final Report

Poul Villien 27 Feb. 1976 83 p 3 Vol.
(Contract ESTEC-2338/74-AK)
(ESA-CR(P)-819-Vol-2) Avail: NTIS HC $5.00

Low temperature Microwave Integrated Circuit (MIC) hermetic sealing procedures were evaluated. Naked semiconductor chips mounted on MIC substrates are used in MIC technology if they are exposed to an inert atmosphere. This is accomplished using hermetic sealing, soldering or welding. From a reliability point of view the best solution would be to use low temperature sealing. From preliminary tests of six epoxies, Araldite AV/HV 100 and Epo-tek H 77 were selected. Environmental tests of MIC-boxes sealed in three diffarent ways: using Araldite AV/HV 100, using Epo-tek H 77 or using indium as sealing material for the lid and Epo-tek H 77 as sealing material for the copper tubes, were made. It is shown that hermetic sealed MIC boxes can be obtained using indium as sealing material for the lid and either of the two epoxies for the copper tubes (for the helium refilling operation) and for the SMA connectors. Author (ESA)

N76-31431# Danish Research Center for Applied Electronics, Hoersholm.

MICROWAVE INTEGRATED CIRCUIT PROCESS INVESTIGATION. WORK PACKAGE 3: DIFFUSION OF CHROMIUM AND NICKEL-CHROMIUM IN GOLD Final Report

Karen Houlberg 15 Dec. 1975 41 p 3 Vol.
(Contract ESTEC-2338/74-AK)
(ESA-CR(P)-819-Vol-3) Avail: NTIS HC $4.00

The influence of Cr and NiCr diffusion into the Au layer of the gold plated thin film an alumina ceramic or sapphire substrates, as used in microwave integrated circuitry, was examined by pulling off soldered copper posts after different temperature exposures. The results of the visual inspection and pull tests were recorded together with the bond failure mode. Visual inspection of the front side of the substrates at different time intervals during temperature storage showed no evidence of NiCr or Cr diffusion. Pull tests showed no significant difference in bond strength between alumina ceramic and sapphire substrates or between NiCr and Cr as seeding layer on these substrates. ESA

N76-31432# Telefonaktiebolaget L. M. Ericsson, Stockholm (Sweden).
STUDY OF BEAM FORMING SYSTEMS FOR PHASED ARRAY ANTENNAS Final Report
Goeran Lidstroem 7 May 1976 206 p
(Contract ESTEC-2351/741-AK)
(MI-Km-6569; ESA-CR(P)-827) Avail: NTIS HC $7.75

The beam forming study is divided in two parts: scannable beam forming and adaptive beam forming. Models of the two systems were built and their performance was studied in order to investigate the feasibility of these types of systems with beam forming at intermediate frequencies. The main effort is aimed at mapping the distribution and sources of phase and amplitude errors as a basis for future design work on operating beam forming systems. Antenna arrays are to operate at SHF. ESA

N76-31433# European Space Agency, Paris (France).
AN L-BAND SHIP ANTENNA WITH VARIABLE CONICAL RADIATION CHARACTERISTIC FOR MARITIME SATELLITE COMMUNICATION SYSTEMS
Hans Forster, Horst Mattes, Arno Schrott et al Apr. 1976 78 p refs Transl. into ENGLISH of 'Eine L-Band-Schiffsantenne mit variabler konischer Strahlungscharakteristik fuer maritime Satelliten-Nachrichtensysteme', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-75-66, 16 Oct. 1975 Original German report available from DFVLR, Cologne DM 32.10
(ESA-TT-287; DLR-FB-75-66) Avail: NTIS HC $5.00

The basic concept, development, and construction of an L-band ship's antenna (1,535 to 1,645 MHz) with stabilized platform for use in a maritime satellite communication system is described in detail. The antenna pattern of the medium gain antenna (minimum gain 7 dB) is a conical beam. The radiation at all azimuth angles is omnidirectional. The elevation angle of the conical beam is infinitely variable. The polarization of the radiation is right hand circular in the direction of the antenna axis and becomes increasingly elliptical for decreasing elevation angles. Due to its simple control system, low weight, and costs, this antenna system is particularly suitable for small ships. Author (ESA)

N76-31434# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
CHARGE-COUPLED DEVICE ANALOG SIGNAL PROCESSING Final Report
M. H. White, I. A. G. Mack, F. C. Kub, and D. R. Lampe Feb. 1976 127 p refs
(Contract N00014-75-C-0283)
(AD-A022595) Avail: NTIS CSCL 09/1

Contents: Serial in/serial out (SI/SO); Parallel in/serial out (PI/SO); Serial in/parallel out (SI/PO); and CCD/Bipolar process technology. GRA

N76-31435# Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RF COUPLING AND RADIATION LEAKAGE PARAMETERS OF SOME TYPICAL JUNCTION BOX CIRCUITRY CONFIGURATIONS Final Report
J. Adelman, P. Nielsen, and R. McCormack Mar. 1976 70 p refs
(AD-A023596; CERL-TR-E-88) Avail: NTIS CSCL 09/1

The objective of the study, composed of two experiments, was to collect baseline data that could be used to determine the degree of electrical coupling between circuits and RF leakage of some common junction box configurations. These experiments assume an empirical approach for measuring RF coupling and leakage parameters due to the complex geometry of the junction box circuitry configuration. The report presents a method for measuring these distributed parameters in order to calculate the values of amplitude and phase coupling for this simplified case from the model. These values are compared to the experimental measurements for the model to verify the experimental procedure. The results of this theory are then extended to the more complex structure of the cabling configuration within the conduit and the junction box. GRA

N76-31436# General Electric Co., Philadelphia, Pa. Space Div.
INFRARED VIDICONS EMPLOYING METAL-SILICON SCHOTTKY DIODE ARRAYS Final Report, 27 Mar. 1974 - 26 Sep. 1975
James P. Spratt, Ruth F. Schwarz, and George W. Racette 1 Oct. 1975 135 p refs
(Contract F19628-74-C-0142; ARPA Order 2444)
(AD-A022645; AFCRL-TR-75-0446) Avail: NTIS CSCL 09/1

Research was conducted to demonstrate the utility of silicon integrated circuit technology in addressing problems of cost and reliability in infrared imaging systems. An experiment was designed to demonstrate the feasibility of infrared imagery using a vidicon tube in which a high velocity beam is used to interrogate a mosaic of palladium-P type silicon Schottky barrier diodes. GRA

N76-31437# Syracuse Univ., N.Y.
FLAT-PACKS UNDER THERMAL SHOCK: A SIMPLIFIED ANALYSIS OF FLEXURAL STRESS IN THE LID-TO-WALL SEAL Final Technical Report, Jul. 1974 - Sep. 1975
Charles Libove Dec. 1975 40 p refs
(Contract F30602-71-C-0312)
(AD-A021253; TR-75-1; RADC-TR-75-308) Avail: NTIS CSCL 09/5

On the basis of a simplified one-dimensional transient heat-flow analysis, formulas are developed for the maximum flexural stresses developed in the lid-to-wall seals of microelectronic flat-packs during thermal-shock screening by Method 1011 of MIL-STD-883. A numerical example is presented to illustrate the use of the formulas. Application of the formulas to package design and to the selection of a screening level for an already designed package is briefly discussed. GRA

N76-31438# ITT Electro-Optical Products Div., Fort Wayne, Ind.
REDUCTION OF VEILING GLARE IN ELECTRO-OPTICAL IMAGE TUBES Final Report, 15 May 1973 - 15 Apr. 1975
E. H. Eberhardt Dec. 1975 83 p
(Contract F33615-73-C-1171; AF Proj. 2001)
(AD-A021254; AFAL-TR-75-111) Avail: NTIS CSCL 09/1

Several techniques for measuring veiling glare in image tubes are identified and the merit of each discussed. The half-field method is determined to be most advantageous and a detailed discussion of this method is included. Veiling glare is described in two regions having different slope of intensity profile away from the half-field terminator. The more sharply falling region is identified as near-field veiling glare and the nearly constant background extending essentially over the full dark field is the far-field veiling glare. Because of observation limitations, near-field veiling glare values have probable error as high as plus or minus 50%. Four types of image tubes were fabricated and evaluated for veiling glare characteristics. The emphasis was to determine the effectiveness of blackening of internal surfaces as a means of reducing veiling glare. GRA

N76-31439# Gudeman Corp., Chicago, Ill.
PRODUCTION ENGINEERING MEASURE FOR POLYSULFONE CAPACITORS FOR SHORT INTRUSION PROXIMITY FUSE Quarterly Report, 24 Aug. - 24 Nov. 1975
Frank A. Lakowski 22 Dec. 1975 23 p refs
(Contract DAAB07-74-C-0337)
(AD-A021259; CSO-705-6; QR-6) Avail: NTIS CSCL 09/1

The object of this production engineering measure is to provide the production engineering necessary to improve the production process techniques of non-metal cased polysulfone capacitors used for short intrusion proximity fuzes. Capacitors are to be capable of meeting the requirements of SCS442 and MIL-C-55514

and are to attain a failure rate of 1% per 1,000 hours at 90% confidence level at rated voltage at 85C. First test article report and test samples for gun shock test were forwarded to Harry Diamond Laboratories for approval. Qualification first test article units placed on extended life test at rated voltage completed 4,000 hours of test time. GRA

N76-31440# Singer Co., Little Falls, N.J. Kearfott Div.
NEW ANGLE ENCODER MODULE Final Report
27 Feb. 1975 14 p refs
(Contract N62269-74-C-0726)
(AD-A021267; Y256A326P06) Avail: NTIS CSCL 09/5

The Angle Encoder plug-in module is used in a combined RF-digital System with intended capability of measuring an RF frequency in the range of 2 - 4 GHz to an accuracy of 1 MHz. An RF pulse of minimum 100 nanosecond duration and -55 dBM minimum usable signal level is required. GRA

N76-31441# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES Quarterly Report, 28 Oct. - 26 Jan. 1976
A. R. Janus, T. W. Bristol, G. W. Judd, and W. R. Smith, Jr. Jan. 1976 74 p refs
(Contract DAAB07-75-C-0044)
(AD-A022607; QR-2) Avail: NTIS CSCL 14/5

The object of the program is the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract and to establish a base and plans which may be used to meet expanded requirements. The primary requirement is the pilot line production of devices that are reliable, reproducible, and low cost. The first phase of this program requires the design, fabrication, testing and shipment of a total of 60 prototype bandpass, tapped delay line and pulse compression SAW filters on both lithium niobate and ST-quartz. This report describes the extent of which this requirement has been met. Implementation of new laboratory equipment and facilities during the last quarter will resolve the major yield problems encountered during the First Engineering Phase. The completion of the Second Engineering Phase will result in a finalization of the electrical specification. GRA

N76-31442# California Univ., Berkeley. Dept. of Chemical Engineering.
STUDY OF MASS AND CURRENT TRANSFER IN MEMBRANE PROCESSES Final Report
K. S. Spiegler 1976 187 p refs
(Grant DI-14-30-3195)
(PB-249818/6; W76-04502; OWRT/S-76/15) Avail: NTIS HC $7.50 CSCL 07A

The study of electrical potential differences between electrolyte solutions separated by desalination membranes led to the conclusion that not only ion-exchange membranes used in electrodialysis but also modified cellulose acetate membranes, used in reverse osmosis, often contain fixed charges. Systematic variation of the concentrations, flow rates, and pressures of sodium chloride solutions flowing past the inner surface of a cylindrical modified cellulose acetate membrane (cured at 94C) led to estimates of the interfacial salt concentration accumulation and indicated that streaming potentials of 6.2 to 8.0 millivolt/100 psi (0.91 - 1.17 millivolt/atm) were obtained. GRA

N76-31443# Failure Analysis Associates, Palo Alto, Calif.
FAILURE ANALYSIS AND FAILURE PREVENTION IN ELECTRIC POWER SYSTEMS Annual Progress Report
Philip M. Besuner, Russell C. Cipolla, Geoffrey R. Egan, Prem Gupta, Duane P. Johnson, Ur Omry, Charles A. Rau, Jr., Terry W. Rettig, and Alan S. Tetelman Aug. 1975 110 p refs
Sponsored by Electric Power Res. Inst.
(PB-249621/4; FAA-75-4-8; EPRI-217-1; APR-1) Avail: NTIS HC $5.50 CSCL 10B

Six technical tasks were identified as necessary to achieve the program goal of increased reliability and safety of electric power plants. Analysis of past operating and malfunction experience was used to identify problem areas which are potentially hazardous or costly and which should be subjected to detailed engineering analysis or simulation tests. Input data on the actual environment and loading and on the materials and structural properties were obtained, and specific engineering analyses were performed. The analyses include flaw indictions in the nozzle to shell weld of the Pilgrim 1 vessel, a corner crack in the nozzle of a test pressure vessel, a crack in a butt weld under the influence of residual stresses, and flaws in the near bore area of steam turbine rotors. GRA

N76-31444# Rockwell International Corp., Cedar Rapids, Iowa. Collins Radio Group.
HIGH STABILITY TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR STUDY Interim Progress Report, 28 Feb. 1974 - 28 Feb. 1975
Alan B. Mroch and Glenn R. Hykes Feb. 1976 111 p
(Contract DAAB07-73-C-0137; DA Proj. 1S7-62705-AH-94)
(AD-A022702; ECOM-73-0137-3; IPR-3) Avail: NTIS CSCL 09/5

The purpose of this program is the further development of a high stability temperature compensated crystal oscillator (HSTCXO) initially developed under contract DAAB07-71-C-0136. This HSTCXO is digitally compensated and is intended for use as a reference frequency source in advanced tactical communications systems. The program is to include detailed investigations into critical areas of size reduction, compensation simplification, and performance improvement. Five advanced exploratory models of the digitally compensated HSTCXO are to be delivered. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-31445 Ohio State Univ., Columbus.
TURBULENT BOUNDARY LAYER ROUGH SURFACE HEAT TRANSFER ON BLUNT BODIES AT HIGH HEATING RATES Ph.D. Thesis
Gary Lynn Denman 1976 263 p
Avail: Univ. Microfilms Order No. 76-17979

An experimental investigation was conducted on the effects of surface roughness on compressible turbulent boundary layer flows over blunt bodies under conditions simulating atmospheric reentry. Experiments were performed in a 50 megawatt arc heater facility which is capable of producing high pressure-high enthalpy air flow necessary for reentry simulation. Heat transfer data were obtained over a range of surface roughness designed to simulate the surface roughness found on typical materials used for reentry thermal protection. The results were correlated with available rough surface heat transfer analysis techniques and recommendations were made relative to analysis techniques most appropriate for design of reentry thermal protection systems. Dissert. Abstr.

N76-31446 California Inst. of Tech., Pasadena.
FRICTION AND HEAT TRANSFER REDUCTION IN TURBULENT FLOW OF DILUTE ASBESTOS FIBER SUSPENSIONS IN SMOOTH AND ROUGH TUBES Ph.D. Thesis
Adrian Leigh Moyls 1976 136 p
Avail: Univ. Microfilms Order No. 76-20431

Friction and heat transfer coefficients were obtained in turbulent flow of dilute asbestos fiber suspensions through a smooth and a rough tube. The 3/8 inch thickness tubes were heated electrically. Suspensions of 50, 300, and 600 ppm asbestos fibers were used at Prandtl numbers of approximately 2, 6, and 11. These were obtained by varying the bulk temperature of the suspension. The surface of the rough tube consisted of a close-packed, granular type of roughness with a height-to-diameter ratio of 0.488. The Reynolds number range studies varied from 10,000 (Pr = 11) to 500,000 (Pr = 2). Maximum friction reductions of 76% in the smooth tube and 87% in the rough tube were observed, along with even greater reductions in heat transfer rates. The data are analyzed in light of analyses

developed previously for Newtonian fluids and extended to dilute fiber suspensions. The results indicate that the turbulent diffusivities are reduced in the wall region and bring about a thicker viscous layer. Dissert. Abstr.

N76-31447 New York Univ., N.Y.
THE EXISTENCE AND DECAY OF WATER WAVES IN THE PRESENCE OF A FIXED OBSTACLE Ph.D. Thesis
Charles Francis Weber 1976 72 p
Avail: Univ. Microfilms Order No. 76-19562

The behavior is investigated of linear water waves in two dimensions on the free surface of an unbounded ocean in the presence of a fixed body on the surface. The major interest is in the behavior for large t. The decay estimates for flows which are symmetric are examined with respect to a vertical line and proves the main theorem. Dissert. Abstr.

N76-31448+ Societe Bertin et Cie, Plaisir (France). Dept. Transferts de Chaleur et de Masse.
MODEL FOR COMPUTATION OF FREE CONVECTION TURBULENT FLOW Final Report [MODELISATION POUR LE CALCUL D'ECOULEMENTS TURBULENTS EN CONVECTION NATURELLE]
A. Delisee, M. Jannot, and G. Locatelli 28 Jun. 1974 90 p refs In FRENCH
(Contract DGRST-72-7-0895)
(Rept-74-Cg-29) Avail: NTIS HC $5.00

An experimental study was carried out to acquire data on turbulent free convection using the geometrical configuration of isothermal vertical plane wall and measuring the temperature and velocity variations at the wall. Two measuring techniques are described: the first using the same plane for temperature and velocity recording and the second using a temperature sensor and a velocity probe. Experiments were carried out using the latter installation; however the mean temperatures measured are not precise and, therefore, the mean velocities not accurate. Using this technique, however, it was possible to obtain high precision variance and covariance by averaging the results. The suitability of temperature measurements with a thermocouple having a time constant less than 0.1 sec is emphasized, and an installation using single probe support with the hot wire and thermocouple wire is envisaged. ESA

N76-31449*# General Dynamics Corp., San Diego, Calif.
THERMAL PERFORMANCE OF A CUSTOMIZED MULTI-LAYER INSULATION (MLI) Final Report
Karl E. Leonhard Apr. 1976 274 p refs
(Contract NAS3-17756)
(NASA-CR-135051; CASD-NAS-76-018) Avail: NTIS HC $9.00 CSCL 20D

The thermal performance of a LH2 tank on a shroudless vehicle was investigated. The 1.52 m (60 in) tank was insulated with 2 MLI blankets consisting of 18 double aluminized Mylar radiation shields and 19 silk net spacers. The temperature of outer space was simulated by using a cryoshroud which was maintained at near liquid hydrogen temperature. The heating effects of a payload were simulated by utilizing a thermal payload simulator (TPS) viewing the tank. The test program consisted of three major test categories: (1) null testing, (2) thermal performance testing of the tank installed MLI system, and (3) thermal testing of a customized MLI configuration. TPS surface temperatures during the null test were maintained at near hydrogen temperature and during test categories 2 and 3 at 289 K (520R). The heat flow rate through the tank installed MLI at a tank/TPS spacing of 0.457 m was 1.204 watts with no MLI on the TPS and 0.059 watts through the customized MLI with three blankets on the TPS. Reducing the tank/TPS spacing from 0.457 m to 0.152 m the heat flow through the customized MLI increased by 10 percent. Author

N76-31450*# Maryland Univ., College Park. Dept. of Aerospace Engineering.
MEASUREMENTS IN THE NEAR-WALL REGION OF A RELAXING THREE-DIMENSIONAL LOW SPEED TURBULENT AIR BOUNDARY LAYER
K. S. Hebbar and W. L. Melnik Jul. 1976 180 p refs
(Grant NGR-21-002-303; NR Proj. 061-212)
(NASA-CR-148814; AE-76-1) Avail: NTIS HC $7.50 CSCL 20D

An experimental investigation was conducted at selected locations of the near-wall region of a three dimensional turbulent air boundary layer relaxing in a nominally zero external pressure gradient behind a transverse hump (in the form of a 30 deg swept, 5-foot chord wing-type model) faired into the side wall of a low speed wind tunnel. Wall shear stresses measured with a flush-mounted hot-film gage and a sublayer fence were in very good agreement with experimental data obtained with two Preston probes. With the upstream unit Reynolds number held constant at 325,000/ft. approximately one-fourth of the boundary layer thickness adjacent to the wall was surveyed with a single rotated hot-wire probe mounted on a specially designed minimum interference traverse mechanism. The boundary layer (approximately 3.5 in thick near the first survey station where the length Reynolds number was 5.5 million) had a maximum crossflow velocity ratio of 0.145 and a maximum crossflow angle of 21.875 deg close to the wall. Author

N76-31451*# Rose-Hulman Inst., Terra Haute, Ind. Division of Civil and Mechanical Engineering.
TURBULENT BOUNDARY LAYERS OVER NONSTATIONARY PLANE BOUNDARIES
A. T. Roper Sep. 1976 67 p refs
(Grant NsG-1258)
(NASA-CR-148861; ME-76-1-ATR) Avail: NTIS HC $4.50 CSCL 20D

Methods of predicting integral parameters and skin-friction coefficients of turbulent boundary layers developing over moving-ground-planes are evaluated using test information from three different wind tunnel facilities at the NASA Langley Research Center. These data include test information from the VSTOL tunnel which is presented for the first time. The three methods evaluated were: (1) relative integral parameter method, (2) relative power law method, and (3) modified law of the wall method. Methods (1) and (2) can be used to predict moving-ground-plane shape factors with an expected accuracy of + or - 10%. They may also be used to predict moving-ground-plane displacement and momentum thicknesses with lower expected accuracy. This decrease in accuracy can be traced to the failure of approximations upon which these methods are based to prove universal when compared with VSTOL tunnel test results. Author

N76-31452# General Electric Co., Philadelphia, Pa. Space Div.
A HEAT PIPE PANEL FOR A HIGH-POWER SPACEBORNE TRANSPONDER
T. R. Scollon Jul. 1976 89 p
(Doc-76SDS030) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

The development, design, and testing are described of a heat pipe isothermalizing panel which can provide primary thermal control for a high-power spaceborne transponder. A panel of this design is suitable for use in a two-channel color television transponder which is the payload of a communications satellite. The heat pipe panel project was successful with respect to all defined objectives. A panel was designed and fabricated and demonstrated, through extensive testing, the ability to meet all imposed thermal requirements. Author

N76-31453# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
TECHNIQUES USED FOR SIMULTANEOUS MEASUREMENTS OF HEAT TRANSFER, PRESSURE, AND DRAG OF RECOVERY SPOILERS IN HYPERSONIC TURBULENT FLOW
R. Berman, A. Hecht, J. Metzger, and D. Nestler 6 May 1976 12 p refs Sponsored in part by AF
(Doc-76SDR021) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

Results are presented for a test program to measure heat transfer, pressure and drag for a variety of spoiler geometries in hypersonic turbulent flow. Such measurements were made simultaneously on three spoilers mounted at the rear of a 6.3 degree half angle cone. Spoiler geometries included variations in height, angle and contour which are thought to be representative of ablated shapes. Nominal free-stream test conditions were Mach 11 and Reynolds number of 20 million based on model length. Heat flux and pressure distributions along spoilers of different geometry were shown to correlate when plotted versus a distance coordinate normalized by the distance to maximum heat flux and pressure, respectively. Magnitude of maximum heat flux and pressure was compared with current prediction techniques. Author

N76-31454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NORMAL IMPINGEMENT OF A CIRCULAR LIQUID JET ONTO A SCREEN IN A WEIGHTLESS ENVIRONMENT
Eugene P. Symons Washington Aug. 1976 31 p refs
(NASA-TM-X-3415; E-8710) Avail: NTIS HC $4.00 CSCL 20D

The normal impingement of a circular liquid jet onto a fine-mesh screen in a weightless environment was investigated. Equations were developed to predict the velocity of the emerging jet on the downstream side of the screen as a function of screen and liquid parameters and of the velocity of the impinging jet. Additionally, the stability of the emerging jet was found to be Weber number dependent. In general, excepting at high velocities, the screen behaved much as a baffle, deflecting the major portion of the impinging flow. Author

N76-31455*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRAPHITE AND ABLATIVE MATERIAL RESPONSE TO CO2 LASER, CARBON-ARC, AND XENON-ARC RADIATION
William D. Brewer Washington Sep. 1976 37 p refs
(NASA-TN-D-8245; L-10814) Avail: NTIS HC $4.00 CSCL 11D

The behavior was investigated of graphite and several charring ablators in a variety of high-radiative heat-flux environments. A commercial-grade graphite and nine state-of-the-art charring ablators were subjected to various radiative environments produced by a CO2 laser and a carbon arc. Graphite was also tested in xenon-arc radiation. Heat-flux levels ranged from 10 to 47 MW/sq m. Tests were conducted in air, nitrogen, helium, and a CO2-N2 mixture which simulated the Venus atmosphere. The experimental results were compared with theoretical results obtained with a one-dimensional charring-ablator analysis and a two-dimensional subliming-ablator analysis. Neither the graphite nor the charring ablators showed significant differences in appearance or microstructure after testing in the different radiative environments. The performance of phenolic nylon and graphite was predicted satisfactorily with existing analyses and published material property data. Good agreement between experimental and analytical results was obtained by using sublimation parameters from a chemical nonequilibrium analysis of graphite sublimation. Some charring ablators performed reasonably well and could withstand radiative fluxes of the level encountered in certain planetary entries. Other materials showed excessive surface recession and/or large amounts of cracking and spalling, and appear to be unsuitable for severe radiative environments.
Author

N76-31456*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STREAKLINE FLOW VISUALIZATION OF DISCRETE-HOLE FILM COOLING WITH NORMAL, SLANTED, AND COMPOUND ANGLE INJECTION
Raymond S. Colladay and Louis M. Russell Washington Sep. 1976 20 p refs
(NASA-TN-D-8248; E-8418) Avail: NTIS HC $3.50 CSCL 20D

Film injection from discrete holes in a three-row, staggered array with five-diameter spacing was studied for three hole angles: (1) normal, (2) slanted 30 deg to the surface in the direction of the main stream, and (3) slanted 30 deg to the surface and 45 deg laterally to the main stream. The ratio of the boundary layer thickness-to-hole diameter and Reynolds number were typical of gas-turbine film-cooling applications. Detailed streaklines showing the turbulent motion of the injected air were obtained by photographing very small neutrally buoyant, helium-filled soap bubbles which follow the flow field. Author

N76-31457# Maryland Univ., College Park. Dept. of Aerospace Engineering.
INVISCID SOLUTIONS OF THE FLOWFIELD IN AN INTERNAL COMBUSTION ENGINE
R. Diwakar, John D. Anderson, Jr., Michael D. Griffin, and Everett Jones 9 Jun. 1976 36 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal on Dec. 1976
Avail: NTIS HC $4.00

The inviscid flow field between the top of the cylinder and the piston in a reciprocating internal combustion engine is calculated as a function of space and time throughout the complete four-stroke cycle with the intake and exhaust valves opening and closing appropriately. These calculations, along with a companion viscous analysis, represent the first multi-dimensional flow field calculations for a complete IC engine cycle. Two-dimensional flow, (an infinite aspect ratio engine) is assumed. Emphasis is placed on the flow field itself; combustion is not treated in detail. The inviscid flow fields are characterized by strong circulation patterns which are influenced by valve location and size, and by engine RPM. The present inviscid calculations are probably better representations of the true flow fields in ordinary aircraft and automobile reciprocating engines than highly viscous, low Reynolds number results. Author

N76-31458# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
POPULATION DENSITY MEASUREMENTS IN FREEJET EXPANSION FLOW OF A PARTIALLY IONIZED GAS
A. Kimura and M. Nishida (Institut fuer Luft- und Raumfart, Technische Hochschule Aachen, W. Ger.) Nov. 1974 37 p refs
(CP-39) Avail: NTIS HC $4.00

Population densities of the 4p and 5p levels of argon atom were measured along the freejet centerline of a partially ionized argon in a low density plasma wind tunnel. The Boltzmann plot for these levels showed that the 4p and 5p levels were not in the Boltzmann equilibrium in the entire region of the freejet. The measured axial distributions of the 4p level population were compared with the theoretical prediction which was made by using modified Thomson's formula for excitation cross section and a simple transition model of neutral argon. For the population distribution of the 4p [3/2] derived from AI 7635, the agreement was good, but the population distribution of the 4p [5/2] derived from AI 8115 showed slower variation than the predicted distribution due to self-absorption. Author

N76-31459*# IBM Federal Systems Div., Huntsville, Ala.
THERMAL CONTACT CONDUCTANCE BETWEEN METALS IN A VACUUM ENVIRONMENT Final Report
16 Aug. 1965 87 p
(Contract NAS8-14000)
(NASA-CR-149959) Avail: NTIS HC $4.50 CSCL 20D

Basic heat transfer data for structural materials used in the Saturn 1B/V 1U component case structural design were obtained. The main emphasis is on thermal contact conductance between dissimilar metallic surfaces, since thermal conductivity values within solids have been sufficiently established previously. The test program outline and test results are described. The following materials were tested: aluminum 6061-T6 (12 samples), aluminum 356 (as cast), almag 35 (as cast), magnesium AZ91C-T4 (4 samples), and mag lithium LA-141 (2 samples). Y.J.A.

N76-31460# European Space Agency, Paris (France).
METHODS FOR HEAT TRANSFER MEASUREMENT
Feb. 1976 164 p refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 165 p Proc. of meeting of DGLR Sci. Comm. 3.4 on 'Testing Tech. in Fluid and Thermodyn.', Goettingen, West Ger., 11 Mar. 1975 Original German report available from DFVLR, Cologne DM 55.80
(ESA-TT-260; DLR-Mitt-75-11) Avail: NTIS HC $6.75

The experimental investigation of aerodynamic heating is important in aerospace engineering and in various other engineering disciplines. During the last years experimental aerodynamics has been increasingly engaged in this field and, therefore, it was felt that reports on the progress achieved should be given during a committee meeting. An interested group of scientists working in this field was invited with support of the VDI/VDE Engineering Society for Measuring and Control. Heating and automotive engineers were also represented. The meeting also considered methods for local and integral heat transfer measurements, and examples of application in various technical disciplines were given. For individual titles, see N76-31461 through N76-31467.

N76-31461 European Space Agency, Paris (France).
MEASUREMENT OF HEAT TRANSFER AND RECOVERY TEMPERATURES IN STRONGLY RAREFIED GASES
H. Legge *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 1-25 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 9-29 (For availability see N76-31460 22-34)

States of flight of a satellite were approximately simulated in a free molecular flow, using a hypersonic vacuum wind tunnel. Both the model and the quantities measured were very small. The difficulties caused by this and the methods to be used are described. Measurements carried out on cones by way of illustration are presented. It is concluded that the Stanton number and the recovery factor can be measured right up to free molecular flow. ESA

N76-31462 European Space Agency, Paris (France).
INFLUENCE ON THE TEMPERATURE FIELD IN SOLID WALLS EXERTED BY THE INCORPORATION OF THERMOCOUPLES
K. Kindler *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 26-46 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 31-50 (For availability see N76-31460 22-34)

The change of temperature in the wall of a cylinder due to built-in jacketed thermocouples was studied. It was found that the thinnest possible thermocouples should be used. Also, the decisive error for the purposes of the determination of the heat flow is brought about by the different material properties of the thermocouple and the body. ESA

N76-31463 European Space Agency, Paris (France).
THE LIQUID CRYSTAL METHOD FOR THE VISUALIZATION AND MEASUREMENT OF HEAT TRANSFER DISTRIBUTIONS
K. A. Buetefisch *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 48-68 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 53-73 (For availability see N76-31460 22-34)
Avail: NTIS

The use of liquid crystals for heat transfer measurements is described. Properties of liquid crystals are discussed, with special emphasis on temperature resolution and adjustment time. Transient heat transfer measurements are dealt with and the experimental apparatus and procedure are presented. It is concluded that the possibility of measuring temperatures and temperature changes on the surface of models with the help of liquid crystals opens up new ways of performing heat transfer measurements in a relatively simple manner. Since the structural change of the liquid crystals is reversible, the experiments can be repeated several times. ESA

N76-31464 European Space Agency, Paris (France).
HEAT TRANSFER IN MOTOR CAR RADIATORS
W.-H. Hucho and K. K. Emmenthal *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 69-86 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 75-88 (For availability see N76-31460 22-34)

A method for designing the water cooling system of a passenger car is outlined. The method is based on experimentally determined values of the heat transmission (dissipation) and the pressure loss of the radiator. A measuring method is described that permits these data to be determined with the necessary accuracy, and some experimental results are reported. The further outlook as regards the application of the results of these measurements to the development of radiators is presented.
Author (ESA)

N76-31465 European Space Agency, Paris (France).
HEAT TRANSFER MEASUREMENTS IN A GUN TUNNEL
G. Stroemsdoerfer *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 89-114 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 91-117 (For availability see N76-31460 22-34)

Using the transient thin skin technique, measurements of the local heat transfer in hypersonic flow were carried out in the gun tunnel of the Institute for Fluid Mechanics at Brunswick Technical University. Various calorimeter gages used are illustrated, and the data acquisition system and the adopted method of data reduction are briefly described. It is shown that in this way measurements of local heat transfer can be carried out in a gun tunnel with a sufficient degree of accuracy and at a moderate expense. Some heat transfer measurements on spheres, spherically nosed cylinders, rotation ellipsoids and in corners with longitudinal flow are presented and compared with other experimental and theoretical results. Author (ESA)

N76-31466 European Space Agency, Paris (France).
HEAT TRANSFER MEASUREMENTS AT FREE STREAM MACH 5 AND 7 IN A LUDWIEG TUBE WIND TUNNEL OF THE DFVLR-AVA
P. Krogmann *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 115-138 refs Transl. into ENGLISH OF "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 119-143 (For availability see N76-31460 22-34)

Heat transfer measurements on slender cones were carried out in the Ludwieg tube tunnel of the DFVLR-AVA using the so-called thin skin technique. This measuring technique is described briefly, and some of the results obtained are presented. Natural transition of the boundary layer from laminar to turbulent could be observed over a range of unit Reynolds numbers from 100,000 to 500,000/cm. The effect of angle of attack on the heat transfer distribution and location of transition on the surface of the model was investigated in the range from 0 to 15 deg.
Author (ESA)

N76-31467 European Space Agency, Paris (France).
BEHAVIOR OF THE HEAT TRANSFER ON BLUNT CONES AS THE RAREFACTION INCREASES
F. Bachour *In its* Methods for Heat Transfer Meas. (ESA-TT-260) Feb. 1976 p 139-155 refs Transl. into ENGLISH of "Verfahren zur Waermeuebergangsmessung", DGLR, Cologne Report DLR-Mitt-75-11, 1975 p 145-161 (For availability see N76-31460 22-34)

The heat transfer onto semispheres and blunt-nosed model cones was measured in the plasma wind tunnel at the Institute for Applied Gas Dynamics of DFVLR. The test equipment is described and the results of the measurements are discussed.
ESA

N76-31468# Los Alamos Scientific Lab., N.Mex.
HELICAL WICK STRUCTURES FOR GRAVITY-ASSIST HEAT PIPES
J. E. Deverall and E. S. Keddy 1976 10 p refs Presented at 2d Intern. Conf. on Heat Transfer, Bologna, Italy, 31 Mar. 1976 (Contract W-7405-eng-36)
(LA-UR-75-2242; Conf-760313) Avail: NTIS HC $3.50

A program was undertaken to develop a wick structure suitable with potassium as a working fluid in heat pipes for thermal control of irradiation capsules having a high heat transfer capability in the temperature range from 870 to 920 K. The most suitable design appeared to be a multiple helix system which provides a low flow resistance, minimum liquid inventory, good liquid distribution, a relatively large vapor passage, and a means for reducing liquid vapor interaction. Seven different wick structures were designed and tested and heat transfer rates up to 10 kW

were attained. The results indicated that high capacity heat pipes can be constructed to operate in the gravity assist mode in a lower temperature range than is possible with sodium. The tests also revealed a new heat pipe limit which has not previously been considered. ERA

N76-31469# Sandia Labs., Albuquerque, N.Mex.
FY75 TCNT EROSION TEST PROGRAM DEVELOPMENT REPORT
M. E. Brown Jan. 1976 105 p refs
(Contract AT(29-1)-789)
(SAND-75-8044) Avail: NTIS HC $5.50

As a result of the successful FY74 missile transpiration-cooled nosetip erosion flight tests, a follow-up program was undertaken for FY75. The program was funded under a reimbursable contract by the Air Force as part of the Sandia/Air Force Material Study program. The objectives were to design and qualify a larger system than that developed in FY74 and flight test it in a naturally occurring storm. This report describes the design and qualification test results, which indicate that all system objectives can be met. Author (ERA)

N76-31470# Los Alamos Scientific Lab., N.Mex.
STABILITY OF THE FLOW IN A SHOCK LAYER
G. N. White Dec. 1975 11 p refs
(Contract W-7405-eng-36)
(LA-6191-MS) Avail: NTIS HC $4.50

The interior stability of an isothermal shock is studied as an initial value problem for inviscid one- and two-dimensional perturbations and as an initial boundary value problem for viscous one dimensional perturbations. The initial steady velocity profile is linear with finite width. Results, obtained from energy integral estimates, indicate stability at low Mach numbers and instability for large Mach numbers. Author (NSA)

N76-31471# Sandia Labs., Albuquerque, N.Mex. Heat Transfer and Fluid Mechanics Div.
FINITE ELEMENT ANALYSIS OF PROBLEMS IN CONVECTIVE HEAT TRANSFER
D. K. Gartling Jan. 1976 34 p refs
(Contract AT(29-1)-789)
(SAND-75-0571) Avail: NTIS HC $5.00

The finite element method was applied to a general class of problems in convective heat transfer. The method was incorporated in a user-oriented computer program. Several typical problems were solved to demonstrate the accuracy and generality of the approach. Author (NSA)

N76-31472# Gottingen Univ. (West Germany). Inst. fuer Physik.
OPTICAL CAVITATION. A NEW METHOD FOR INVESTIGATING CAVITATION BUBBLE DYNAMICS [OPTISCHE KAVITATION. EINE NEUE METHODE ZUR UNTERSUCHUNG DER DYNAMIK VON KAVITATIONSBLASEN]
W. Lauterborn Bonn DOKZENTBw 1975 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-75-18) Avail: NTIS HC $4.50; DOKZENTBw DM 30

An experimental method for studying bubble dynamics was investigated using giant light pulses of a ruby laser to produce cavitation bubbles. High speed photography was used to study bubble vibrations in water and silicone oils, bubble collapse, bubble dynamics near boundary surfaces, and the interaction of cavitation bubbles. The formation of liquid jets appears to be the dominating phenomenon of cavitation bubble dynamics. The possibility of the reproducible creation of spatial bubble systems using holographic lenses is discussed. ESA

N76-31473# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
STATIC MEASUREMENTS ON THE INFLUENCE OF DRIVING FLUID (AIR AND WATER) AND SIZE ON THE PERFORMANCE OF STANDARD PNEUMATIC FLUIDISTORS. SECTION 1: COMPARISONS AND NOTES Final Report
K. S. Nystroem, R. F. Boucher, and L. Filipsson 1974 81 p refs 5 Vol.
(FFA-TN-AU-701-Sect-1) Avail: NTIS HC $5.00

The performance characteristics of a number of commercially available miniature fluidistors were determined over a wide range of Reynolds number, by testing the original devices with air and water and large scale models with water. There is no trend discernable common to all the performance parameters, but the variation of each separate parameter is presented and discussed. A limited amount of information indicates the effect of Mach and cavitation numbers. Author (ESA)

N76-31474# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
STATIC MEASUREMENTS ON THE INFLUENCE OF DRIVING FLUIDS (AIR AND WATER) AND SIZE ON THE PERFORMANCE OF STANDARD PNEUMATIC FLUIDISTORS. SECTION 2, PART 1: EXPERIMENTAL RESULTS, BISTABLE DEVICES OF GIVEN SIZE Final Report
K. S. Nystroem, K. Eriksson, and L. Filipsson 1975 134 p refs 5 Vol.
(FFA-TN-AU-701-Sect-2-Pt-1) Avail: NTIS HC $6.00

Unedited x-y plotter diagrams are presented showing the supply, control, output, and transfer characteristics that were measured on different standard pneumatic fluidistors keeping the supply pressure, Reynolds number, and power equal when changing the driving fluid from air to water. The measurements were reproduced several times for each characteristic to ensure accuracy. For the same reason the temperature of the supply fluid was kept within a range of 20 + or - 1 C. Author (ESA)

N76-31475# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
STATIC MEASUREMENTS ON THE INFLUENCE OF DRIVING FLUIDS (AIR AND WATER) AND SIZE ON THE PERFORMANCE OF STANDARD PNEUMATIC FLUIDISTORS. SECTION 2, PART 2: EXPERIMENTAL RESULTS, ANALOG DEVICES OF GIVEN SIZE Final Report
K. S. Nystroem, K. Eriksson, and L. Filipsson 1975 81 p refs 5 Vol.
(FFA-TN-AU-701-Sect-2-Pt-2) Avail: NTIS HC $5.00
For abstract, see N76-31473.

N76-31476# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
STATIC MEASUREMENTS ON THE INFLUENCE OF DRIVING FLUIDS (AIR AND WATER) AND SIZE ON THE PERFORMANCE OF STANDARD PNEUMATIC FLUIDISTORS. SECTION 2, PART 3: EXPERIMENTAL RESULTS, LOGIC DEVICES OF GIVEN SIZE Final Report
K. S. Nystroem, K. Eriksson, and L. Filipsson 1975 97 p refs 5 Vol.
(FFA-TN-AU-701-Sect-2-Pt-3) Avail: NTIS HC $5.00
For abstract, see N76-31473.

N76-31477# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
STATIC MEASUREMENTS ON THE INFLUENCE OF DRIVING FLUIDS (AIR AND WATER) AND SIZE ON THE PERFORMANCE OF STANDARD PNEUMATIC FLUIDISTORS. SECTION 2, PART 4: EXPERIMENTAL RESULTS, 10 (5) TIMES ENLARGED REPLICAS OF GIVEN BISTABLE AND ANALOG DEVICES Final Report
K. S. Nystroem, K. Eriksson, and L. Filipsson 1975 105 p refs 5 Vol.
(FFA-TN-AU-701-Sect-2-Pt-4) Avail: NTIS HC $5.50
For abstract, see N76-31473.

N76-31478# Aeronautical Research Inst. of Sweden, Stockholm. Fluid Technology Lab.
A REVIEW AND AN INVESTIGATION CONCERNING JETS OF POLYOX AND WATER IN CONNECTION WITH THE FLUID MECHANICS OF POWER FLUIDICS Final Report
K. S. Nystroem, R. F. Boucher, and L. Filipsson 1974 93 p refs
(FFA-TN-AE-701) Avail: NTIS HC $5.00

An experimental investigation was conducted into the behavior of water jets dosed with increasing amounts of polymer additive to produce a non-Newtonian jet fluid. As a preliminary to this investigation the properties of Newtonian jets are reviewed and

compared with various semi-empirical models. The behavior of non-Newtonian fluids and drag reducing additives is also reviewed with a view to application in this and later investigations. Experimental investigation indicates that the gross behavior of these jets conforms to that of the Newtonian jet. Some differences in detail, in particular velocity profile and rate of spread close to the nozzle, are determined but are not conclusive. Corrections are necessary to the pitot tube data due to the effect of polymer. It is considered that these must be approximate, and thorough investigation can only be conducted by non-invasive techniques. It is concluded that the investigation provides some insight and information into the possible behavior of fluidistors carrying non-Newtonian fluids and the understanding and correlation of the data derived from them. Author (ESA)

N76-31479# National Aerospace Lab., Amsterdam (Netherlands). Div. Fluid Dynamics.

THE CHARACTER OF FLOW UNSTEADINESS AND ITS INFLUENCE ON STEADY STATE TRANSONIC WIND TUNNEL MEASUREMENTS

R. Ross and P. B. Rohne 13 Jun. 1975 8 p refs Presented at the AGARD Fluid Dyn. Symp. on Wind Tunnel Design and Testing Tech., London, 6-10 Oct. 1975

(NLR-MP-75025-U) Avail: NTIS HC $3.50

The results of research on flow unsteadiness and on the possible effects of noise variation on the flow in the NLR transonic slotted wind tunnel are presented. The flow unsteadiness in wind tunnels has been separated into three modes: free stream turbulence convected by the flow, sound wave type disturbances travelling with the speed of sound with respect to the flow, and temperature spottiness convected with the flow. It was found, using the hot wire technique and microphones, that sound wave type disturbances (noise) are the most important type of unsteadiness in some transonic tunnels. Furthermore, tests were carried out on a supercritical airfoil with noise levels of 0.35% and 0.6% in cp rms, the other flow conditions being identical. No effect of the change in noise level was found on trailing edge and shock induced separation. The additional noise caused transition to occur more forward by about 4% of the chord.

Author (ESA)

N76-31480# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

DYNAMIC BEHAVIOR OF A VORTEX IN A SHEAR FIELD Ph.D. Thesis - Goettingen Univ., West Ger. [UEBER DAS DYNAMISCHE VERHALTEN EINES WIRBELS IN EINEM SCHERFELD]

Friedemann Albers Feb. 1976 74 p refs In GERMAN; ENGLISH summary

(Rept-2/1976) Avail: NTIS HC $4.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 18,30

It has been found previously that single vortex-like structures in the wake of a circular cylinder can leave the wake. The distance of such isolated structures from the wake is of the order of the cylinder diameter. The mechanism of this phenomenon by the interaction between a single vortex and a shear flow was investigated. For this purpose the equations of motion were solved by means of a method of numerical integration. A two-dimensional, incompressible, nonviscous channel flow was investigated under different initial conditions. The parameters of the problem were chosen in such a way that the results could be compared with the previous results. The superposition of a vortex with a shear flow leads to accelerating forces acting perpendicularly to the direction of the shear flow. The computations show that accelerating forces occur only if the velocity profile of the shear flow is a nonlinear one. This is in good agreement with previous results. Author (ESA)

N76-31481# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

INVESTIGATION OF BOUNDARY LAYER-LIKE FLOWS WITH PRESSURE GRADIENTS AT HIGH FREE STREAM MACH NUMBERS Ph.D. Thesis - Tech. Hochschule Aachen

Ernst Heinrich Hirschel 16 Mar. 1976 82 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-76-22) Avail: NTIS HC $5.00; DFVLR, Cologne DM 31

The applicability of numerical methods for the solution of systems of partial differential equations, the mathematical difficulties and the demands of flow physics which arise due to the use of these solution methods are discussed by means of theoretical investigations of boundary layer-like flows with pressure gradients in main-stream direction and cross-flow direction. The flow fields investigated are hypersonic-slip flow boundary layers and structures of oblique shock waves and their intersections. In both cases a mixed initial value-boundary value problem has to be solved which is described by governing equations derived from the Navier-Stokes equations. Results of calculations are presented, as well as comparisons with experimental data.

Author (ESA)

N76-31482# Exeter Univ. (England). Dept. of Engineering Science.

A THEORETICAL INVESTIGATION OF HIGH-SPEED AXISYMMETRIC TURBULENT MIXING LAYERS WITH LARGE TEMPERATURE DIFFERENCES

P. W. Carpenter London Aeron. Res. Council 1976 43 p refs Supersedes ARC-35428 Sponsored by Rolls-Royce Ltd. (ARC-CP-1345; ARC-35428) Avail: NTIS HC $4.00; HMSO £1.80; PHI

A two-parameter integral method was developed for predicting the meanflow characteristics of high speed axisymmetric turbulent mixing layers with large temperature differences. Results are presented graphically and in tabular form for such quantities as spreading rate, entrainment velocity, potential-core length, and velocity along the dividing streamline. These results are for the case of a jet issuing into a quiescent medium; a range of jet Mach numbers from 0 to 5 is taken. For each Mach number results are presented corresponding to values of the temperature ratio across the mixing layer ranging from 0 to infinity. On the whole the available experimental data agree well with the theoretical predictions. Results for the case where the jet issues into a moving stream are not presented graphically or in tabular form, but approximate analytical formulae are given whereby most of the quantities of interest may be determined.

Author (ESA)

N76-31483# European Space Agency, Paris (France).

EQUATIONS OF MOTION FOR THE INVESTIGATION OF HIGH MACH NUMBER, BOUNDARY-LAYERLIKE FLOWS WITH PRESSURE GRADIENTS

Ernst Heinrich Hirschel Mar. 1976 26 p refs Transl. into ENGLISH of "Bewegungsgleichungen fuer die Untersuch. grenzschichtaehnlicher Stroemungen mit Druckgradienten bei hohen Anstroemmachzahlen", DFVLR, Porz, West Ger. Report DLR-Mitt-75-04, 1975 Original German report available from DFVLR, Porz, West Ger. DM 12,30

(ESA-TT-207; DLR-Mitt-75-04) Avail: NTIS HC $4.00

Equations of motion for the investigation of boundary layers and of high Mach number boundary layerlike flows with pressure gradients are derived by means of a single order of magnitude analysis of the general governing equations of fluid mechanics. Author (ESA)

N76-31484# Purdue Univ., Lafayette, Ind. School of Aeronautics Astronautics and Engineering Sciences.

INVESTIGATIONS OF FLUIDICALLY CONTROLLED SUSPENSION SYSTEMS FOR TRACKED VEHICLES Final Report, 1 Apr. - 30 Sep. 1975

William R. Eberle and Mel M. Steele Sep. 1975 97 p refs (Contract DAAF07-75-M-2119)

(AD-A022636; TACOM-TR-12072) Avail: NTIS CSCL 13/6

The use of fluidic components in a hydropneumatic suspension system is expected to significantly improve certain performance characteristics of the suspension system. Several candidate variable damping and variabie springing systems are discussed. The damping and springing parameters are functions of relative position (between the wheel and the vehicle body), relative velocity, and vertical acceleration of the vehicle body. A mathematical model is derived for each candidate system. A brief performance analysis of selected systems is presented. GRA

N76-31485# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

HEAT DISSIPATION FROM TURBULENT OPEN CHANNEL FLOW Completion Report
Paul G. Mayer and Michael D. Moss Jan. 1976 93 p refs
(Contract DI-14-31-0001-4010)
(PB-250745/7; ERC-0376; W76-05248; OWRT-A-048-GA(2))
Avail: NTIS HC $5.00 CSCL 13B

The purpose was to establish quantitatively the effect of turbulence on heat dissipation in open channels. The study investigated systematically factors which affect heat transfer from open channel flow. Thus, an attempt was made to combine the thermodynamic and hydrodynamic phenomena in order to obtain design parameters. An examination was made of channel roughnesses as a means of additional mixing and hence of additional thermal transfer. The laboratory study showed the quantitative increase in evaporative cooling as a consequence of increased turbulent mixing in open channel flow and suggested artificially roughened channels as an alternate means of accomplishing the rejection of excess industrial heat into the environment. The theoretical study provided a means for the application of the study results to the design of open channels as an alternate means of dissipation of excess industrial heat.
GRA

N76-31486# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THERMOMECHANICAL ABLATION Ph.D. Thesis
George Y. Jumper, Jr. Sep. 1975 192 p refs
(AF Proj. 7381)
(AD-A021275; DS/ME/75-1) Avail: NTIS CSCL 22/3

In order to investigate the heat and mass transfer aspects of thermomechanical ablation, ablation experiments were performed with models made of pure carbon dioxide (CO2) and a glass bead-CO2 composite. The experiments were performed in a low subsonic, low turbulence jet at ambient pressure and near 0 C temperature. The model geometry was a hemispherical forebody-cylindrical afterbody with a diameter of 25mm. The stagnation point mass transfer of the pure CO2 models was 6.2% less than predicted by equilibrium theory. The distribution around the hemisphere generally agreed with the predicted laminar heat transfer result of monotonically decreasing heat transfer with distance from the stagnation point. The internal temperature response was approximately 5% higher than the theoretically predicted wall temperature. These results could be correlated by the inclusion of a nonequilibrium sublimation model into the theoretical prediction equations.
GRA

N76-31487# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
TRANSPORT OF MASS AND ENERGY IN POROUS MEDIA DUE TO NATURAL CONVECTION. THE GEOTHERMAL BASIN PROBLEM Progress Report, 1 Jun. 1974 - 30 Nov. 1975
D. R. Kassoy, J. S. Rinehart, and C. Archambeau 5 Jan. 1976 148 p
(Grant NSF AER-76-03429)
(PB-252917/0; CUMER-76-1; NSF/RA-760042) Avail: NTIS HC $6.00 CSCL 08G

The modeling is discussed of physical processes occurring in liquid-dominated geothermal systems. The topics which are described include: (1) an analysis of field data from the Mesa Anomaly, Imperial Valley, California leading to a physical characterization of that system; (2) presence and role of fault zones in a geothermal area; (3) deformations occurring in a model of a geothermal area due to earthtide loading; (4) heat and mass transfer in fault zones and large-scale geothermal systems; and (5) deformation and failure of rock systems in a saturated, high temperature and pressure environment.
GRA

N76-31488# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
THE EFFECT OF FREE GASES ON PRESSURE TRANSIENTS Final Report, 1 Jun. 1973 - 31 May 1976
C. S. Martin, M. Padamanabhan, and D. C. Wiggert (Mich. State Univ.) Jun. 1976 228 p refs
(Grant NSF GK-38570)
(PB-253223/2) Avail: NTIS HC $8.00 CSCL 20D

Transient two-phase flow of air-water mixtures was experimentally and analytically investigated. The principal objective was the determination of the effect free gas has on pressure wave propagation. Experiments were conducted in 1/2 inch and 1 inch copper tubes. Transient pressures were generated by the rapid closure of a downstream valve. Shock waves and their structure were investigated for a very rapid valve closure. One-dimensional flow models were developed. Minor differences of each of the models compared reasonably well with the measured transient pressures. The advantages and disadvantages of the various models are discussed.
GRA

N76-32098 European Space Agency, Paris (France).
DETERMINATION OF THE TEMPERATURE FIELD WITHIN A SOLID IN PERMANENT OSCILLATORY REGIME
Jean Surugue, Emile LeGrives et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 1-16 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 189-200 (For availability see N76-32097 22-99)

N76-32102 European Space Agency, Paris (France).
NONHOMOGENEOUS, LINEARIZED PROBLEMS RELATED TO SMALL MOVEMENTS OF INCOMPRESSIBLE LIQUID IN DEFORMABLE TANKS
Jacques Leclerc, Pierre Salaun et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 55-75 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 229-244 (For availability see N76-32097 22-99)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-31489* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATIC COEFFICIENT TEST METHOD AND APPARATUS Patent
Carl L. Haehner and John L. Tarpley, inventors (to NASA) Issued 31 Aug. 1976 7 p Filed 9 Jun. 1975 Supersedes N75-25966 (13 - 17, p 2070)
(NASA-Case-GSC-11893-1; US-Patent-3,977,231;
US-Patent-Appl-SN-585420; US-Patent-Class-73-9) Avail: US Patent Office CSCL 14B

The static coefficient of friction between contacting surfaces of a plurality of bodies is determined by applying a load to the bodies in a direction normal to the contacting surfaces. Opposite ends of a flexible filament are connected to a load cell and the first of the bodies. A motor continuously moves the second of the bodies away from the load cell at constant velocity at right angles to the force of the normal load so that the first body moves intermittently relative to the second body across a contact surface between them. The load on the surfaces, the nature of the surfaces, and the speed of the first body relative to the load cell are such that the filament is alternately and cyclically tensioned and relaxed as the movement occurs. The maximum tension occurs at the incipient stages of movement of the first body relative to the second body. The load cell derives a series of measurements which are coupled to an x-y recorder, from which the maximum forces of the filament are determined to enable the static coefficient of friction to be determined. From the maximum forces and the normal force, the coefficient is determined. For determining coefficients of friction where there are large compression loads, the normal load is applied with a calibrated compression spring that is deflected by a predetermined amount determined by a spring load vs. deflection calibration curve.
Official Gazette of the U.S. Patent Office

N76-31490* National Aeronautics and Space Administration. Pasadena Office, Calif.

HIGH RESOLUTION FOURIER INTERFEROMETER-SPECTROPHOTOPOLARIMETER Patent
Alain L. Fymat, inventor (to NASA) (JPL) Issued 31 Aug. 1976 11 p Filed 5 May 1975 Supersedes N75-22688 (13 - 14, p 1652) Sponsored by NASA
(NASA-Case-NPO-13604-1; US-Patent-3,977,787; US-Patent-Appl-SN-574219; US-Patent-Class-356-106S; US-Patent-Class-356-244; US-Patent-Class-356-209; US-Patent-Class-356-114) Avail: US Patent Office CSCL 14B

A high-resolution Fourier interferometer-spectrophotopolarimeter is provided using a single linear polarizer-analyzer the transmission axis azimuth of which is positioned successively in the three orientations of 0 deg, 45 deg, and 90 deg, in front of a detector; four flat mirrors, three of which are switchable to either of two positions to direct an incoming beam from an interferometer to the polarizer-analyzer around a sample cell transmitted through a medium in a cell and reflected by medium in the cell; and four fixed focussing lenses, all located in a sample chamber attached at the exit side of the interferometer. This arrangement can provide the distribution of energy and complete polarization state across the spectrum of the reference light entering from the interferometer; the same light after a fixed-angle reflection from the sample cell containing a medium to be analyzed; and the same light after direct transmission through the same sample cell, with the spectral resolution provided by the interferometer.
Official Gazette of the U.S. Patent Office

N76-31491+ Paris-Sud Univ., Orsay (France). Lab. de Physique des Solides.
LIQUID CRYSTALS DISTORTION MECHANISMS AND THERMAL EFFECTS ON ORIENTATION DISTORTION Final Report [ETUDE DES MECANISMES DE DISTORSION DE CRISTAUX LIQUIDES ET EFFETS THERMIQUES DE DISTORSION DE L'ORIENTATION]
R. Guyon Dec. 1974 20 p refs In FRENCH
(Contract DGRST-73-7-1483)
Avail: NTIS HC $3.50

A reliable method for obtaining planar liquid crystals is presented. The optical axis may be parallel to the planes or may be oblique due to precoating of thin films evaporated under oblique incidence. Adhesion on these surfaces is shown to be superior to that obtained with the polishing method and allows controllable and reliable orientation of both the nematic and smectic phases. A systematic study of the properties of films evaporated under oblique incidence and the anisotropic elastic mechanism of orientation was performed. Optical and thermal measurements were also performed to further the understanding of the thermal convection threshold together with the relation between convective and movements and loss of orientation. ESA

N76-31492+ Paris-Sud Univ., Orsay (France). Inst. d'Electronique Fondamentale.
STUDY AND IMPLEMENTATION OF IMPULSE HIGH RESOLUTION, INTENSE MAGNETIC FIELD NMR SPECTROMETER FOR VARIOUS NUCLEI Final Report [ETUDE ET REALISATION D'UN SPECTROMETRE RMN A IMPULSION MULTINOYAUX EN HAUTE RESOLUTION ET EN CHAMP MAGNETIQUE INTENSE]
M. Sauzade 9 Jun. 1975 25 p refs In FRENCH
(Contract DGRST-72-7-0419)
Avail: NTIS HC $3.50

A high resolution H1, H2, C13, F19 and P31 NMR spectrometer was developed. Special emphasis was placed on the NMR sondes, the electronics of the spectrometer, and signal data acquisition and processing. The various sondes, operating at RF, are discussed. Electronic aspects include irradiation and observation of the nucleus studied, hetero or homonuclear radiation, and magnetic field stabilization. Data acquisition, using an HP 2116 or a Texas 980 A is discussed and results of proton and fluor resonance measurements are presented. ESA

N76-31493*# Kanner (Leo) Associates, Redwood City, Calif.
AN ADVANCED ELECTROCHEMICAL OZONE RADIOSONDE
K. Roennebeck and D. Sonntag Washington NASA Sep. 1976 13 p refs Transl. into ENGLISH from Z. Meteorol. (East Germany), v. 26, no. 1, 1976 p 15-19
(Contract NASw-2790)
(NASA-TT-F-17203) Avail: NTIS HC $3.50 CSCL 14B

Basic electrochemical reactions and relations utilized by the radiosonde are discussed along with the composition of the device. The device is to be used together with the Soviet RKS-5 radiosonde as a balloon-borne instrument for altitudes up to 35 km. The principles of operation of the ozone radiosonde are examined and plotting and correction procedures are described. The device is used to obtain data on the ozone concentration in the atmosphere above the territory of the German Democratic Republic. Author

N76-31494*# Life Systems, Inc., Cleveland, Ohio.
THE DEVELOPMENT OF AN ELECTROCHEMICAL TECHNIQUE FOR IN SITU CALIBRATING OF COMBUSTIBLE GAS DETECTORS Final Report, 1 Sep. 1975 - 31 Aug. 1976
J. W. Shumar, J. B. Lantz, and F. H. Schubert Jul. 1976 61 p refs
(Contract NAS9-14658)
(NASA-CR-150947; LSI-ER-284-13) Avail: NTIS HC $4.50 CSCL 14B

A program to determine the feasibility of performing in situ calibration of combustible gas detectors was successfully completed. Several possible techniques for performing the in situ calibration were proposed. The approach that showed the most promise involved the use of a miniature water vapor electrolysis cell for the generation of hydrogen within the flame arrestor of a combustible gas detector to be used for the purpose of calibrating the combustible gas detectors. A preliminary breadboard of the in situ calibration hardware was designed, fabricated and assembled. The breadboard equipment consisted of a commercially available combustible gas detector, modified to incorporate a water vapor electrolysis cell, and the instrumentation required for controlling the water vapor electrolysis and controlling and calibrating the combustible gas detector. The results showed that operation of the water vapor electrolysis at a given current density for a specific time period resulted in the attainment of a hydrogen concentration plateau within the flame arrestor of the combustible gas detector. Author

N76-31495# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Division.
A MINIATURIZED DIFFERENTIAL PRESSURE TRANSDUCER WITH TIME CONSTANT FOR R/V FLIGHT TEST APPLICATIONS
J. Cassanto, F. George, D. Stewart, C. Droms, and A. Robison 7 Apr. 1976 13 p refs
(Doc-76SDR018) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

A laboratory and shock tunnel concept was applied to a differential pressure transducer to produce a small, compact flight package. The concept employs a differential pressure transducer with a time constant/lagged reference (controlled leak rate) that vents to the vacuum of free space while over the top in the trajectory and utilizes that vacuum as a reference pressure during reentry. A miniaturized Kulite silicon differential pressure transducer was modified with a time constant (controlled leak in the reference pressure cavity) and subjected to ground tests. The modified differential pressure transducer is considerably smaller (0.1 volume) than a low range absolute pressure transducer. Ground tests consisting of reentry pressure simulations showed that the small differential sensor with a time lagged reference produces results identical to those of a large absolute pressure transducer. Author

N76-31496*# Panametrics, Inc., Waltham, Mass.
FLIGHT OF A UV SPECTROPHOTOMETER ABOARD GALILEO 2, THE NASA CONVAIR 990 AIRCRAFT Addendum Report, 1 Dec. 1975 - 31 Mar. 1976
Bach Sellers, Jean L. Hunderwadel, and Frederick A. Hanser Mar. 1976 39 p refs
(Contract N00014-73-C-0316)

(NASA-CR-148863; AD-A023229; PANA-UVS-8-Add) Avail: NTIS HC $4.00 CSCL 14/2

An ultraviolet interference-filter spectrophotometer (UVS) fabricated for aircraft-borne use on the DOT Climatic Impact Assessment Program (CIAP) has been successfully tested in a series of flights on the NASA Convair 990, Galileo II. UV flux data and the calculated total ozone above the flight path are reported for several of the flights. Good agreement is obtained with the total ozone as deducted by integration of an ozone sonde vertical profile obtained at Wallops Island, Virginia near the time of a CV-990 underpass. Possible advantages of use of the UVS in the NASA Global Atmospheric Sampling Program are discussed. GRA

N76-31497# California Univ., Berkeley. Coll. of Engineering.
HIGH G CALIBRATION OF ACCELEROMETERS
G. W. Brown Oct. 1975 21 p refs Sponsored by ERDA
(UCRL-13670) Avail: NTIS HC $3.50

The relation between the strain in an elastic wave traveling along a slender rod and the acceleration of a free end as the wave reflects from that end is given by the equation eta = 1/(2c)integral adt, where a = acceleration, c = wave velocity, and eta = strain in the rod. An air gun and projectiles were built to induce the strain wave in the rod. The system was designed to achieve accelerations of 100,000 g's and pulse lengths of from 50 to 150 micro-seconds. An instrument has been built to compare the peak values of the strain as recorded by a foil strain gage and the integral of the acceleration as recorded by an accelerometer fastened to the free end of the rod. The instrument is designed in such a way that the calibration constant of the accelerometer is displayed immediately on a digital voltmeter. Also, in conjunction with a time interval counter, the instrument measures the wave velocity, c. Author (ERA)

N76-31498# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
METHODS AND SYSTEMS FOR INERTIAL ACCELERATION MEASUREMENT USING LASERS [VERFAHREN UND SYSTEME ZUR LASEROPTISCHEN MESSUNG VON BESCHLEUNIGUNGEN NACH DEM KRAFTPRINZIP]
Wolfgang Holzapfel Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 202 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-2072; GfW-RV-11-TL-2/72-B)
(BMFT-FB-W-75-30) Avail: NTIS HC $7.75; ZLDI, Munich DM 42.45

The physical and measuring principles of some new types of inertial accelerometers are specified. These instruments measure acceleration by use of coherent optical methods and laser systems. Theoretical and experimental studies are carried out using different systems of such laser accelerometers. The experimental work using the earth's gravitational field for instrument input demonstrated an accuracy of measurement and resolution of the order of 0.000013 magnitude; however, this value depends on the seismic noise level at the measuring location and on the precision of the testing equipment used, and gives no principal limit for the accuracy and resolution. Theoretical studies show methods to realize laser accelerometers with a dynamic range of 6/10 decades and an acceleration resolution up to 10 sup(-10) g. These instruments may be of interest in navigation, seismology, and general measurement techniques.
Author (ESA)

N76-31499# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT, APRIL - JUNE 1975
Jun. 1975 17 p
Avail: NTIS HC $3.50

Observations were made with the Herstmonceux photographic zenith tube. The Greenwich atomic time scale was determined from the investigated mean of four cesium clocks with rate corrections. ESA

N76-31500# National Aerospace Lab., Amsterdam (Netherlands). Div. Fluid Dynamics.
EGOIST: THE NLR APPROACH TO WIND TUNNEL DATA SYSTEMS
P. H. Fuijkschot 14 Jul. 1975 12 p Presented at the 6th Intern. Congr. on Instrumentation in Aerospace Simulation Facilities, Ottawa, 22-24 Sep. 1975
(NLR-MP-75030-U) Avail. NTIS HC $3.50

A new generation of systems for data acquisition, process control, and data reduction recently installed at major NLR windtunnels and calibration facilities is described. It is characterized by a distribution of functions in a hierarchical organization and a standardization on modular hardware and software wherever possible. Each EGOIST is controlled by an 8k mini computer which is connected online to the NLR data network. The analog front end features rather unique conditioning units. They combine in a self-contained package all functions for one high accuracy analog channel, including analog to digital conversion. The design goals and the general configuration are discussed, after which the conditioning unit concept is treated in more detail. The applicability is illustrated by a description of several systems realized. Author (ESA)

N76-31501# Giessen Univ. (West Germany). Inst. fuer Physik.
CALORIMETRIC DOSIMETRY OF FAST NEUTRONS CONSIDERING THE CALORIC DEFECT [KALORIMETRISCHE DOSIMETRIE SCHNELLER NEUTRONEN UNTER BERUECKSICHTIGUNG DES KALORISCHEN DEFEKTS]
W. Schoeck and G. Weimer Bonn DOKZENTBw 1975 92 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-75-24) Avail: NTIS HC $5.00; DOKZENTBw DM 30

The problem of absolute energy dosimetry with a calorimeter in the radiation field of a neutron generator is discussed. The following measurement methods were investigated: gamma and neutron dosimetry, and calorimetry. A calorimeter was developed, and a list was made to determine the energy dose and the calorimetric defect. The results are discussed. ESA

N76-31502# World Meteorological Organization, Geneva (Switzerland).
INSTRUMENT DEVELOPMENT INQUIRY
1976 105 p Revised
(WMO-232-Rev-2) Avail: NTIS HC $5.50, WMO, Geneva Sw. Fr. 15

A total of 21 WMO members contributed information on 142 meteorological instruments under development. The information for each of the 22 categories of measuring instruments (ranging from temperature and radiation measurement to captive balloon techniques and automatic weather stations) includes parameter sensed, status of development, technical characteristics, tests and cost data. ESA

N76-31503# European Space Agency, Paris (France).
SPECTROSCOPIC TEMPERATURE DETERMINATION AFTER THE TWO-LINE METHOD FOR TIME-VARYING TEMPERATURES
Rudolf Ferdinand Neubauer Apr. 1976 24 p refs Transl. into ENGLISH of 'Spektroskopische Temperaturbestimmung nach dem Zweilinienverfahren bei zeitlich schwankender Temperatur', DFVLR, Brunswick Report DLR-FB-75-65, 13 Oct. 1975 Original German report available from DFVLR, Cologne DM 13
(ESA-TT-286; DLR-FB-75-65) Avail: NTIS HC $3.50

Theoretical analysis and experimental results indicate that spectroscopic temperature measurements after the 2-line method, applying an integrating rather than a time-resolving technique, yield both too high and too low temperatures if the temperature in the gas varies with time. Temperatures were measured for a rotating arc (T = 8000 K and T = 12000 K) and within a hot jet (T = 6000 K). Author (ESA)

N76-31504# Air Force Systems Command, Wright-Patterson AFB, Ohio.
ANGULAR MOVEMENT PICK-UP
A. V. Anikin, L. A. Bubnov, Yu. N. Kuroedov, S. N. Orekhov, and N. A. Rantsev 7 May 1975 10 p Transl. into ENGLISH from Russian Patent no. 339932 23 May, 1963 p 1-2
(AD-A016142; FTD-ID(RS)I-1298-75) Avail: NTIS CSCL 14/2

A device related to automatic control and regulation systems is described. The geared rotor is hollow and is rigidly attached to the reversible electric motor's rotor to whose stator the pick-ups immobile stator is rigidly attached. The annular magnets and

measuring windings are located in the circular groves of magnetic disks fastened to the immobile shaft that passes through the pick-ups center. The output voltage amplitude is increased along with accuracy. GRA

N76-31505# Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
SURFACE EXTENSOMETER INSTALLATION PROCEDURE
D. H. Yardley, C. R. Nelson, and R. W. Rabus Oct. 1975 29 p
(Grant NSF GI-37862)
(PB-252707/5; NSF/RA/T-75-072) Avail: NTIS HC $4.00 CSCL 14B

This manual describes in detail the design, preparation, and installation of 6 point rod extensometers used to monitor deflections of the limestone roof of an underground test room. The layout of the test room and locations of the extensometers are presented as well as a diagram of the 6 point rod extensometer. GRA

N76-31506# Defence Research Establishment Ottawa (Ontario).
APPLICATION OF THERMAL IMAGING TECHNIQUES IN THE FIELD UNDER EXTREME COLD CONDITIONS
D. J. Hidson Jan. 1976 29 p refs
(AD-A022627; DREO-TN-76-1) Avail: NTIS CSCL 14/5

A thermal imaging camera, modified for operation under extremely cold conditions, was used to examine the thermal properties of CF clothing and equipment items during a winter exercise. Photographs are presented to illustrate the capabilities of the modified thermal imaging system in detecting heat loss from clothing and equipment. GRA

N76-31507# Fairchild Space and Defense Systems, Syosset, N.Y.
ADVANCED LOW ALTITUDE PANORAMIC CAMERA SYSTEM Final Report, Jul. 1973 - Jul. 1974
Seymour Kaye and Arthur Magill Jan. 1976 161 p refs
(Contract F33615-73-C-1298)
(AD-A023446; AFAL-TR-74-327) Avail: NTIS CSCL 14/5

An engineering design study program was performed to investigate new camera concepts and configurations for an Advanced Low Altitude Panoramic (ALAP) camera. The effort was divided into two phases. The initial phase was concerned with conceptual studies of various photosensor and film-storage techniques, both conventional and unconventional. The conceptual study resulted in selecting the one photosensor concept that would meet all the specification requirements for further detailed design and analysis. The system chosen for the second or detail design phase was the Dual Focal Length Split Scan Panoramic Camera System. The main features of this camera are a unique 'Zoom' type lens with a movable rear group of elements that results in two distinct focal length positions; continuous film motion with uniform velocity for both focal lengths; and modular 'building block' construction which allows the user flexibility of configuration. GRA

N76-31508# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THEORY OF THE MOVING-WIRE TECHNIQUE FOR STUDYING POLYMER FLAMMABILITY. 1: WIRE TEMPERATURE UNDER FORCED CONVECTION
L. W. Hunter Feb. 1976 51 p refs Prepared in cooperation with Dept. of Com.
(Grants NSF GI-44088; NFPCA-75007)
(PB-252847/9; APL/JHU-FPP-TR-25; NSF/RA-760086) Avail: NTIS HC $4.50 CSCL 14B

Mathematical solutions are presented of a wide range of models that describe the temperature distribution in a solid circular cylinder of infinite length, that moves in the direction of its axis. The models differ in complexity depending on whether the cylinder is uniform or dependent on the azimuthal angles and longitudinal position. When the heat carried by conduction in the longitudinal direction is small compared to that carried by the motion of the solid, the well-known transient solutions for a stationary cylinder apply. The applicabilities of the various models to polymer flammability are discussed. GRA

N76-31509# Defence Research Establishment Ottawa (Ontario).
A PORTABLE GAMMA DOSE-RATE METER FOR SURVIVAL USE
Philip C. East and Michel A. Periard Mar. 1976 14 p
(AD-A022628; DREO-TN-75-17) Avail: NTIS CSCL 18/4

A miniature gamma dose-rate meter is described which uses three differently coloured flashing light emitting diodes to cover the dose-rate range 0.1 to 100 R/h. This low cost instrument has considerable potential as a survival instrument for both military and civilian application. GRA

N76-31510# Holosonics, Inc., Richland, Wash. Medical Instrumentation Div.
EXPLORATORY AND DEVELOPMENTAL STUDIES LEADING TOWARD OPTIMIZATION OF ACOUSTICAL HOLOGRAPHY IMAGING OF CARDIOVASCULAR SYSTEM, VOLUME 2 Annual Report, 15 Aug. 1974 - 1 Nov. 1975
Byron B. Brenden and John L. Deichman 1 Dec. 1975 88 p refs
(Grant HV-3-2991)
(PB-253116/8; NIH/NHLI-N01-HV-3-2991-2-Vol-2) Avail: NTIS HC $4.00 CSCL 06E

The objectives of the second phase of this program were to better the imaging capability of the liquid surface acoustical holography system as it relates to the cardiovascular system, to continue the safety study involved with insonification of fertilized fish eggs and to explore the feasibility of using electron spin resonance (ESR) to detect tissue damage from ultrasonic insonification. Lens designs and transducer fabrication techniques were tested. Improved images of peripheral vessels were obtained using ultrasonic frequencies from 1.5 to 4.0 MHz. Neither the fish study nor the ESR study indicated any tissue damage at intensities and pulse duration parameters similar to those used in the acoustical holography system or even at intensity levels up to 600mW/sq cm. Free radicals were detected by electron spin resonance methods after insonification at intensities well above 1 W/sq cm but not at any intensity below 1 W/sq cm. GRA

N76-31511# Pennsylvania State Univ., University Park. Applied Research Lab.
DIGITAL RECONSTRUCTION OF ACOUSTIC HOLOGRAMS
R. L. Cohen 9 Jan. 1976 143 p refs
(Contract N00017-73-C-1418)
(AD-A022666; TM-76-05) Avail: NTIS CSCL 09/2

The subject of this study is the development of a computer program capable of reconstructing images from acoustic holograms. The theory on which the program is based is that of Gabor type (on-axis) holography. A hologram is an intensity recording of the interference of an object wave and a reference wave. A reconstruction from the hologram contains four components, namely the reference wave squared, the object wave squared, the conjugate image and the true image. Digital techniques for isolating the four components are presented along with examples of reconstructions. Reconstructions from digitally generated holograms of point sources are discussed. It was found that interference between images of point sources can drastically affect image intensity. Image intensity is also dependent on source position relative to the hologram aperture. A source located near the edge of the aperture reconstructs with only half the intensity of the same source located at the aperture center. Methods of hologram generation are compared for image quality. Phase-only and binary techniques add spurious high frequency information to the images, but in the application of source location this is not a serious handicap. Digitization range (-1, 1) was found superior to (0, 1) in that it eliminates two of the unwanted image noise terms in tha phase-only and binary cases. Holograms containing only the conjugate image component give vastly improved signal to noise ratios compared with the other types, but they require knowledge of the amplitude and phase at every sample point rather than just the intensity. GRA

N76-31186 European Space Agency, Paris (France).
COMPACT LASER VELOCITY METER FOR MEASUREMENTS IN HIGHLY TURBULENT FLOWS
Alain Boutier and Jean Lefevre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975

p 108-110 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 59-60 (For availability see N76-31180 22-01)

N76-32108 European Space Agency, Paris (France).
INTERFEROMETRIC SENSOR FOR THE MEASUREMENT OF VIBRATIONS OF MECHANICAL STRUCTURES
Michel Philbert and Gerard Dunet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 110-137 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 289-299 (For availability see N76-32103 22-99)

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-31512* National Aeronautics and Space Administration. Pasadena Office, Calif.
REFLECTED-WAVE MASER Patent
Robert C. Clauss, inventor (to NASA) (JPL) Issued 31 Aug. 1976 11 p Filed 12 Feb. 1975 Supersedes N75-16827 (13 - 08, p 0888) Sponsored by NASA
(NASA-Case-NPO-13490-1; US-Patent-3,978,417; US-Patent-Appl-SN-549418; US-Patent-Class-330-4; US-Patent-Class-331-94) Avail: US Patent Office CSCL 20E

A number of traveling-wave, slow-wave maser structures, containing active maser material but absent the typical ferrite isolators, are immersed in a nonuniform magnetic field. The microwave signal to be amplified is inserted at a circulator which directs the signal to a slow-wave structure. The signal travels through the slow-wave structure, being amplified according to the distance traveled. The end of the slow-wave structure farthest from the circulator is arranged to be a point of maximum reflection of the signal traveling through the slow-wave structure. As a consequence, the signal to be amplified traverses the slow-wave structure again, in the opposite direction (towards the circulator) experiencing amplification equivalent to that achieved by a conventional traveling-wave maser having twice the length. The circulator directs the amplified signal to following like stages of amplification. Isolators are used in between stages to prevent signals from traveling in the wrong direction, between the stages. Reduced signal loss is experienced at each stage. The high gain produced by each slow-wave structure is reduced to a moderate value by use of a nonuniform magnetic field which also broadens the line width of the maser material. The resulting bandwidth can be exceptionally wide. Cascaded stages provide high gain, exceptionally wide bandwith and very low noise temperature.
Official Gazette of the U.S. Patent Office

N76-31513 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF THE DEGRADATION OF A LASER BEAM BY HIGH INTENSITY TURBULENCE Ph.D. Thesis
George Francis Cudahy 1976 175 p
Avail: Univ. Microfilms Order No. 76-21358

The reduction of intensity of the far field central spot formed by a collimated laser beam traversing high intensity turbulences near the laser source was correlated with the statistical behavior of the turbulence generated refractive index perturbations causing the intensity reduction. An analytical method to predict the intensity degradation using statistical turbulence parameters was developed. The variables in analytical relation were laser beam diameter and wave number, path length of turbulence traversed, and structure functions of traversed refractive index perturbations. Since refractive index perturbations could not be readily measured a method to approximate these perturbations, via the equations of state, using temperature and velocity perturbation correlation functions was developed. An experiment to measure the actual far field central spot intensity reduction and the temperature and velocity perturbations causing that reduction was conducted.
Dissert. Abstr.

N76-31514*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INDEPENDENT GAIN AND BANDWIDTH CONTROL OF A TRAVELING WAVE MASER Patent Application
David L. Trowbridge, inventor (to NASA) (JPL) Filed 26 Jul. 1976 14 p Sponsored by NASA
(NASA-Case-NPO-13801-1; US-Patent-Appl-SN-708796) Avail: NTIS HC $3.50 CSCL 20E

An X band traveling wave maser of the folded comb type is provided with two figure eight coils for gain and bandwidth control. One figure eight coil covers the full length of the comb structure for bandwidth adjustment of an external magnetic field. The other figure eight coil covers a central half of the comb structure for independent gain adjustment of the external magnetic field. The half of each figure eight coil at the turn around end of the comb structure is oriented to aid the external magnetic field, and the half of each figure eight coil at the input-output end of the comb structure is oriented to buck the external magnetic field. The maser is pumped in the push push mode with two different frequencies.
NASA

N76-31515# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
METAL VAPOR LASER STUDIES
R. S. Anderson, B. G. Bricks, T. W. Karras, L. W. Springer, and T. E. Buczacki 3 Nov. 1975 15 p refs
(Doc-75SDS030) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

Two discharge-heated lasers using lead and copper chloride as the laser materials were tested. Lasing was obtained on the near uv lines (4062A and 4057A) of lead. Weak lasing was observed at 4062A with fast risetime excitation. Much stronger emission (3.5 mW average) was obtained at 4057A when the risetime of the current pulse was reduced. In a small diameter tube (1.2 cm) lasing with CuCl2 was maintained with tube temperatures up to 700 C. In a large tube (2.3 cm) the temperature range was restricted to a narrow region near 400 C, but long term operation at 2W output was obtained.
Author

N76-31516# Materials Research Labs., Maribyrnong (Australia).
THE DESIGN OF A HIGH-PRESSURE MULTI-KILOWATT CO2 LASER
R. E. Whitcher and R. McLeary Jan. 1976 18 p refs
(Rept-646) Avail: NTIS HC $3.50

The design of a multi-kilowatt electric discharge CO2 laser is described. This laser, which utilizes plasma injection, operates at the relatively high pressure of 30 kPa (0.3 atm.) and delivers a continuous output power of 7.5 kW at an efficiency of 10%.
Author

N76-31517# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
A STUDY OF CO2 GASDYNAMIC LASERS. PART 2: GAIN COEFFICIENT AND LASER POWER
G. Kamimoto and Ken T. Len May 1976 38 p refs
(CP-40-Pt-2) Avail: NTIS HC $4.00

Experimental results of gain coefficient measurements and of laser power measurements of a CO2 gasdynamic laser using a shock tube are presented. Two mixtures: (1) 5%CO2 + 25%N2 + 70%He and (2) 10%CO2 + 90%He are used for the gain measurements in a shock speed range of 1.6 to approximately 2.4 mm/micro sec. The first mixture is used for the laser power experiment in a shock speed range of 1.0 to approximately 1.8 m/micro sec. In the theoretical treatment, a power theory which describes the correlations of fluid mechanics-vibrational relaxation-radiative energy transfer of a CO2 gasdynamic laser is developed. The numerical results indicate that the vibrational energy of the neutrino sub 3 mode releases in the front portion of the cavity mirrors, while that of the neutrino sub nucleon mode drains to the neutrino sub 3 mode in the rear portion. The fall of the CO2 (v3, neutrino sub 3, neutrino sub 1) population inversions is characterized by the photon life time which is two to three order shorter than the relaxation time of the neutrino sub nucleon yields neutrino sub 3 ft transition. Therefore, the rise of the power intensity has a nature of a pulsation feature. Laser power is a summation of the radiation energy inside the cavity. Both the experimental and numerical results indicate that it is dependent

primarily to the 3/2 power of the shock speed for stagnation pressure below 10 atmospheres. Author

N76-31518# Los Alamos Scientific Lab., N.Mex.
GENERATION AND AMPLIFICATION OF NANOSECOND DURATION MULTILINE HF LASER PULSES
R. L. Getzinger, K. D. Ware, and J. P. Carpenter 1976 5 p refs Presented at the Meeting of Soc. of Photo-Opt. Instrumentation Engr., Palos Verdes Estates, Calif. Sponsored by ERDA (Contract W-7405-eng-36)
(LA-UR-76-368; Conf-760318-1) Avail: NTIS HC $3.50

High power, fast rising pulses of hydrogen fluoride laser energy suitable for laser fusion target interaction experiments can in principle be generated by directing an electro-optically shuttered oscillator pulse through one or more electron beam driven amplifiers. A three stage HF master oscillator power amplifier (MOPA) configuration was constructed and tested using SF6-C2H6 in which an E-O generated 4 ns FWHM pulse was amplified in an electron beam excited third stage and subsequently isolated with a Brewster angle splitter. Independent experiments in which a 100 ns FWHM pilot pulse interacted with the power amplifier demonstrated for the first time complete extraction of the available laser energy. NSA

N76-31519# Sandia Labs., Albuquerque, N.Mex.
HIGH ENERGY HF PULSED LASERS
E. L. Patterson and R. A. Gerber 1976 7 p refs Presented at the SPIE/SPSE Tech. Symp., Reston, Va., 22 Mar. 1976 Sponsored by ERDA
(SAND-76-5175; Conf-760306-1) Avail: NTIS HC $3.50

Recent experiments show that pulsed HF lasers are capable of producing high energy with good efficiency. Preliminary experiments show that the laser radiation from the high gain medium can be controlled with a low power probe laser beam or with low level feedback. NSA

N76-31520# Sandia Labs., Albuquerque, N.Mex.
HIGH POWER ATOMIC IODINE PHOTODISSOCIATION LASERS
R. E. Palmer, T. D. Padrick, and E. D. Jones 1976 9 p refs Presented at SPIE/SPSE Technical Symp., Reston, Va., 22 Mar. 1976 Sponsored by ERDA
(SAND-76-5185; Conf-760306-2) Avail: NTIS HC $3.50

The atomic iodine photodissociation laser was developed into a system capable of producing nanosecond or shorter pulses of near infrared radiation with energies well in excess of a hundred J. Operating characteristics, advantages, and potential problem areas associated with this laser are discussed. NSA

N76-31521# Physics Lab. RVO-TNO, The Hague (Netherlands).
A LONG RANGE SCANNED LASER ACTIVE IMAGING SYSTEM
C. W. Lamberts Dec. 1975 22 p refs
(PhL-1975-52; TDCK-67233) Avail: NTIS HC $3.50

An active imaging system was developed which utilizes a scanned Nd-YAG laser beam for target illumination. Images obtained at distances up to 1.5 km using different signal processing methods are shown. A new technique of generating a 3-D display is presented. Author (ESA)

N76-31522# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A MODEL FOR FLUORINE RECOMBINATION AT A METAL SURFACE Ph.D. Thesis
Eric J. Jumper Dec. 1975 121 p refs
(AD-A021269; DS/ME/75-2) Avail: NTIS CSCL 20/5

A steady state model for fluorine atom recombination for temperatures less than 800 K on a metal catalytic surface was developed based on the Rideal heterogeneous reaction mechanism. The model is comprised of three distinct processes: (1) the bonding process of gas-phase fluorine atoms to the metal surface, (2) the collision and subsequent recombination process of gas-phase atoms and surface-bonded fluorine atoms and (3) the rate process at which the bonding and recombination take place considering the surface coverage. The model was compared with actual fluorine recombination data taken for a nickel tube in which a gas mixture of atomic fluorine, molecular fluorine, and argon flowed. The results of this comparison validated the model and extended the verification of the Rideal mechanism for heterogeneous recombination. Computations using the wall recombination model were made for a two-dimensional slit nozzle of the type used in fluorine chemical lasers, using a two-dimensional chemically reacting laminar boundary layer computer code. GRA

N76-31523# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONTINUING STUDIES IN THE DESIGN OF A MONOREAGENT CHEMICAL LASER SYSTEM EMPLOYING NITROSYL CYANIDE M.S. Thesis
Paul H. Flynn Dec. 1975 71 p refs
(AD-A023362; GEP/CH/75D-1) Avail: NTIS

The reaction kinetics for the decomposition of nitrosyl cyanide (NCNO) were investigated in a shock tube by means of infrared emission analysis in an attempt to determine the rate constants associated with the proposed unimolecular reaction. Nitrosyl cyanide was diluted to 0.4% in argon so that the unimolecular decomposition pathway could be studied independently of other decomposition reactions. The temperature range of the study was 1420 - 1730K with the total pressure varying from 1 to 2 atm. Kinetic measurements were made by following the decay of emission of the upsilon 1 fundamental at 4.87 mu, upsilon 2 at 6.70 mu, and upsilon 3 at 12.02 mu. The reaction was shown to follow the unimolecular (free radical) pathway. The unimolecular rate constants for the Hinshelwood-Lindemann mechanism were obtained from the emission-decay data and were converted into second order rate constants. The Arrhenius energy of activation is 28,992 plus or minus 2730 cal/mole. Theoretical calculations based on the RRKM and Slater integrals were completed by numerical computer analysis. The RRKM results were in excellent agreement with experimental data while the Slater results were not in agreement. This finding suggests that under the reported conditions, vibrational equilibrium is maintained during reaction. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-31524* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF MAKING HOLLOW ELASTOMERIC BODIES Patent
Howard F. Broyles (JPL), Jovan Moacanin (JPL), and Edward F. Cuddihy, inventors (to NASA) (JPL) Issued 31 Aug. 1976 6 p Filed 28 Mar. 1975 Supersedes N75-21637 (13 - 13, p 1514) Sponsored by NASA
(NASA-Case-NPO-13535-1; US-Patent-3,978,187; US-Patent-Appl-SN-563050; US-Patent-Class-264-129; US-Patent-Class-264-161; US-Patent-Class-264-219; US-Patent-Class-264-304; US-Patent-Class-264-305; US-Patent-Class-264-308; US-Patent-Class-264-310; US-Patent-Class-264-318; US-Patent-Class-264-334; US-Patent-Class-427-230) Avail: US Patent Office CSCL 13H

Annular elastomeric bodies having intricate shapes are cast by dipping a heated, rotating mandrel into a solution of the elastomer, permitting the elastomer to creep into sharp recesses, drying the coated mandrel and repeating the operation until the desired thickness has been achieved. A bladder for a heart assist pump in which a cylindrical body terminating in flat, sharp horizontal flanges fabricated by this procedure has been subjected to over 2,500 hours of simulated life conditions with no visible signs of degradation. Official Gazette of the U.S. Patent Office

N76-31525+ Aluminium Pechiney, Voreppe (France).
STUDY ON THE WETTABILITY AND ADHESION OF ORGANIC COATINGS AND GLUES ON ALUMINUM AND ITS ALLOYS Final Report [ETUDE DE LA MOUILLABILITE ET DE L'ADHERENCE DE REVETEMENTS ORGANIQUES ET DE COLLES SUR L'ALUMINIUM ET DE SES ALLIAGES]
J. J. MeynisdePaulin Oct. 1974 67 p In FRENCH

(Contract DGRST-72-7-0697)
Avail: NTIS HC $4.50

The adhesion of varnishes was tested using the following methods: high pressure fluid jet, centrifugal force detachment, ultrasounds, gluing of varnishes, and traction. Adhesion tests were carried out using Technyl Z15 901 and epoxy phenolic varnishes. The adhesion of epoxyphenolic varnishes used in cannery was measured varying some industrial factors such as surface finishing, varnish burning, and autocleavage behavior. The characteristics of Technyl Z 15 901 were investigated and a high performance method for measuring the adhesion of epoxy phenolic varnishes used to protect the metals in the cannery was found. The wettability of aluminum surfaces was examined as were interfaces after rupturing, air micropockets, the peeling resistance of Araldite 106 gluing, and salt spray tests. Some recommendations relating to adhesion control of varnishes, surface finishing, picking etc., are given. ESA

N76-31526*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METHOD FOR ATTACHING A FUSED-QUARTZ MIRROR TO A CONDUCTIVE METAL SUBSTRATE Patent Application
George Sonnenschein (Faraday Labs., Inc.) and Daniel McKeown, inventors (to NASA) (Faraday Labs., Inc.) Filed 27 Aug. 1976 11 p Sponsored by NASA
(NASA-Case-MFS-23405-1; US-Patent-Appl-SN-718267) Avail: NTIS HC $3.50 CSCL 13H

A method for attaching a fused quartz mirror to a conductive metal substrate is studied. The steps of tinning one surface of a fused quartz mirror with a solder of substantially pure indium are examined. A discussion of tinning a metallic substrate with an indium eutectic alloy consisting essentially of indium, bismuth, lead, and tin is also included. Tin has a melting point substantially below that of indium, heating the eutectic alloy to a temperature substantially above its melting point, but below that of the solder. The mirror is floated into place, and subsequently cools the alloy to a temperature substantially below its melting point. NASA

N76-31527*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Astronautical Engineering and Mechanics.
SOME WEAR STUDIES ON AIRCRAFT BRAKE SYSTEMS
Ting-Long Ho Oct. 1975 78 p refs
(Grant NGR-33-018-152)
(NASA-CR-134989) Avail: NTIS HC $5.00 CSCL 11G

An initial investigation of worn surfaces in friction pads and steel rotors used in current aircraft brakes was carried out using electron microprobe and X-ray diffraction analysis. It consists of the topographical study and the analysis of chemical element distribution. Based upon this initial examination, two approaches, microscopic and macroscopic have been conducted to interpret and formulate the wear mechanism of the aircraft brake materials. Microscopically, the wear particles were examined. The initiation and growth of surface cracks and the oxidation were emphasized in this investigation. Macroscopically, it has been found that, for the current copper based brake material sliding against 17-22 AS steel in a caliper brake, the surface temperature raised due to frictional heat is nonlinearly proportional to the load applied and slide time with speed at 1750 rpm. The wear of brake materials is then proportional to this temperature and is also a function of the melting temperature for copper. Author

N76-31528# Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
PREDICTION OF CREEP FATIGUE DAMAGE IN MAJOR STEAM GENERATOR COMPONENTS
Hisao Haneda, Mamoru Araoka, Katsuya Setoguchi (Nagasaki Tech. Inst.), Jerry D. Fox (Combust. Eng., Inc., Windsor, Conn.), and Walter F. Siddall (Combust. Eng., Inc., Windsor, Conn.) May 1976 11 p refs Presented at 38th Ann. Meeting of the Am. Power Conf., 20-22 Apr. 1976; sponsored by Ill. Inst. of Technol.
(MTB-105) Avail: NTIS HC $3.50

A review of the strength of heavy thick-walled steam generator components, subject to severe temperature transients, is presented. Sample life consumption charts are given for several representative thick-walled pressures parts of a utility steam generator. An elastic plastic creep analysis was made of an infinitely long thick-walled cylinder with stress concentration factors. Suggestions for use of these life consumption charts in power plant operation to obtain maximum power plant availability and maneuverability are included Author

N76-31529*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADJUSTABLE SECURING BASE Patent Application
Paul P. Zebus (Rockwell Intern. Corp. Downey, Calif.) and Poley N. Packer, inventors (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 7 Sep. 1976 11 p
(Contract NAS9-14000)
(NASA-Case-MSC-19666-1; US-Patent-Appl-SN-721150) Avail: NTIS HC $3.50 CSCL 13I

A device with a flexible securing base for which the surface radius of curvature can be adjusted to adapt it to support workpieces with different curved surfaces is described. The apparatus comprises a flexible thin plate with a support surface for accommodating a part or workpiece. The flexible plate is supported at its centerline across its width by a 'U' shaped trough member which forms a pivot about which the plate can bend. The inverted 'T' shaped bases support the ends of the pivot member and provide the support legs for the apparatus. A gear linked deflecting mechanism permits rapid manual adjustment of the curvature of the hold down plate and support surface to the exact concave or convex cylindrical curvature needed to support different workpieces such as tiles for roller coating or similar operations. A large knurled knob with vertical threaded shaft is used to pivotally move the linkage arm and rotate the horizontal shaft. NASA

N76-31530# Sandia Labs., Albuquerque, N.Mex.
INFLUENCE OF LEAD FRAME THICKNESS ON THE FLEXURE RESISTANCE AND PEEL STRENGTH OF THERMOCOMPRESSION BONDS
D. R. Johnson and D. L. Willyard Dec. 1975 25 p refs
(Contract AT(29-1)-789)
(SAND-75-0304) Avail: NTIS

The flexure resistance and peel strength of 0.18 mm and 0.25 mm thick lead frames, which were thermocompression bonded to metallized ceramic substrates, were determined. Comparison was made on the basis of existing bonding thermodes with parameters varied to yield a range of bond zone deformations extending from 20 to 65 percent. Bond strength was evaluated through a 90 in. peel test, while flexure resistance was determined through a cycle of 30 in. flex and return with a 200 g deadweight attached to the lead. The data reveal that the 0.18 mm leads yielded an increase in flexure resistance of 80 and 53 percent over the 0.13 and 0.25 mm thick leads respectively. Author (ERA)

N76-31531# California Univ., Livermore. Lawrence Livermore Lab.
METHODS FOR SURFACE TREATING METALS, CERAMICS, AND PLASTICS BEFORE ADHESIVE BONDING
L. P. Althouse 2 Feb. 1976 21 p refs
(Contract W-7405-eng-48)
(UCID-16997) Avail: NTIS HC $4.00

Methods for pretreating the surfaces of metals, ceramics, and plastics before they are coated with adhesive and used in assembly are described. The treatments recommended have been used successfully in the laboratory. Many are used in the assembly of nuclear devices. However, an unusual alloy or complex configuration may require trials before a specific surface treatment is chosen. Author (NSA)

N76-31532# Nederlands Scheeps-Studiecentrum TNO, Delft. Scheepsbouw Afdeling.
MARINE REFRIGERATION ENGINEERING. PART 8: INVESTIGATIONS INTO THE DISTRIBUTION OF CARGO TEMPERATURES IN A LOADED FULL-SIZE MODEL OF A SHIP'S REEFER SPACE
P. J. Verhoef (Central Tech. Inst. TNO, Apeldoorn, Neth.) Dec. 1974 26 p refs
(Rept-219-M; TDCK-66886) Avail: NTIS HC $4.00; Ned. Scheepsstudiecentrum TNO, Delft DFI. 10

Investigations were carried out with regard to the temperature

distribution in palletized cargo loaded in a ship's reefer space. Attention was paid to the usefulness of pallets concerning the distribution of air under the stack by measuring the temperature distribution in the cargo under various practical conditions. The influence of the construction of the air distribution system was also investigated. The measurements indicate that pallets are capable of distributing air, even under adverse conditions. The temperature distribution in a cargo proved to be determined mainly by the temperature distribution in the air flow from the refrigeration unit to the cargo. Author (ESA)

N76-31533# Royal Aircraft Establishment, Farnborough (England).
THE NON-LINEAR DEFORMATION OF A THIN FLEXIBLE RING BY THE MOVEMENT OF TWO CIRCULAR DISCS
M. R. Abbott Dec. 1975 18 p refs
(RAE-TM-Math-7508; BR50508) Avail: NTIS HC $3.50

A problem involving a thin circular flexible ring (flexspline) fitted round two circular disks is discussed. The disks were moved radially outwards and the distorted shape of the ring and the bending moment were calculated as a preliminary to obtaining results of practical importance to the engineering of helicopter drive transmission devices. ESA

N76-31534# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
UTILIZATION OF THE PENDULUM DEVICE FOR STUDY OF LEAD LUBRICATION Final Report [UTILISATION DU DISPOSITIF PENDULAIRE POUR L'ETUDE DE LA LUBRIFICATION AU PLOMB]
Manola Romero Jun. 1976 37 p refs In FRENCH
(Contract ESTEC-1728/72-HP)
(ESA-CR(P)-825) Avail: NTIS HC $4.00

The properties of lead films for use as lubricants in ball bearings for vacuum applications were investigated. The case considered is heavy friction during low amplitude oscillations, produced in a pendulum device. The effect of various parameters such as contact fit, film structures, and fabrication type of the sample upon damping and film wear was observed. It was found that friction increases for narrow fits. Level and uniformity of friction attained after running-in confirm the adequacy of lead film lubricants for this type of contact, especially for less narrow fits. Tests with films of various thicknesses have shown that films of 0.1 micron and more cannot support the higher contact pressure. ESA

N76-31535# National Centre of Tribology, Risley (England).
[RESEARCH ACTIVITIES AT THE EUROPEAN SPACE TRIBOLOGY LABORATORY] Progress Report, 1975
E. J. Robbins [1976] 19 p refs Sponsored by ESA
(ESA-ESTL-21; ESA-CR(P)-826) Avail: NTIS HC $3.50

The objectives of the laboratory are: testing of spacecraft mechanisms, particularly their tribological components, and provision of a source of tribological experience and experimental data in the design and construction of mechanisms by the European space industry. Tests on seven different mechanisms have continued or have been completed during the year. Techniques for rapid thermal cycling of mechanisms under test have been improved so that larger temperature transients can be automatically superimposed on the shaft of solar array drive or despin mechanisms. The most important achievement of the supporting development program has been the progress towards establishing a reliable system for the lead plating of ball bearings by ion deposition. ESA

N76-31536# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
INFLUENCE OF ELASTOHYDRODYNAMIC LUBRICATION ON THE LIFE AND OPERATION OF TURBINE ENGINE BALL BEARINGS. BEARING DESIGN MANUAL Final Technical Report, Mar. 1972 - Mar. 1975
J. I. McCool, Y. P. Chiu, J. Y. Liu, W. J. Crecelius, and J. W. Rosenlieb May 1975 306 p refs
(Contract F33615-72-C-1467; SKF Proj. 414-2)
(AD-A020500; SKF-AL75P014; AFAPL-TR-75-25) Avail: NTIS CSCL 21/5

This report is a self contained manual describing the rationale, use and predictive accuracy of an advanced state-of-the-art ball bearing analysis computer program. This program embodies mathematical models describing the lubricant's role in bearing behavior that were developed or adopted for this purpose. Mathematical descriptions of these models are set forth along with a detailed description of the program's organization, method of solution and convergence criteria. Input data preparation forms and program output are discussed in detail, and examples of each are included. Comparisons are given of the program's predictions and the values of heat generation rate, film thickness, and cage and ball rotational speeds measured in tests of a 125-mm bore angular-contact ball bearing operating at various axial loads at speeds up to 3,100,000.DN. Parametric runs of the program in which key variables are systematically altered are included and interpreted. GRA

N76-31537# General Electric Co., Pittsfield, Mass. Ordnance Systems.
TEST OF AUTOMATIC TEMPERATURE CONTROLLED HYDROSTATIC FAN DRIVE Final Report, Jun. 1972 - Jul. 1975
R. P. Moncy and R. L. Rio Aug. 1975 47 p
(Contract DAAE07-72-C-0306)
(AD-A021140; TACOM-TR-12106) Avail: NTIS CSCL 21/7

In order to improve vehicle fuel economy and performance, it is desirable to employ a cooling fan system that will operate independently of engine speed and react solely to heat rejection requirements. This report describes the design, testing, and development of a temperature-controlled hydrostatic fan drive system intended for cooling engine and transmission oil in a military tracked vehicle. The testing program demonstrated satisfactory system performance and durability characteristics. GRA

N76-31538# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
BRAKING EFFICIENCY TEST TECHNIQUE Final Technical Report, Jul. 1973 - Nov. 1974
R. D. Ervin and C. B. Winkler Mar. 1976 221 p refs
(Contract DOT-HS-031-3-765)
(PB-252621/8; UM-HSRI-PF-74-13-1; DOT-HS-801-551) Avail: NTIS HC $7.75 CSCL 13F

A method is described whereby vehicle stopping performance can be specified, measured, and compared independently of the test surface. The method provides for an independent measure of the prevailing friction potential of the test surface. This measure is used to normalize the measured stopping performance of the test vehicle. The concept presented is tailored toward a safety argument and toward rulemaking as a potential adaptation to braking effectiveness requirements which currently exist. A new mobile tire dynamometer, developed for this program, is discussed. GRA

N76-31539# Creare, Inc., Hanover, N.H.
REVIEW AND ANALYSIS OF STATE-OF-THE-ART OF MULTIPHASE PUMP TECHNOLOGY
P. W. Runstadler, Jr. Feb. 1976 195 p refs
(PB-252749/7; CREARE-TN-226; EPRI/NP-159; TR-1) Avail: NTIS HC $7.50 CSCL 13K

The technologies are reviewed which bear upon the fluid dynamic understanding of multiphase flow pump behavior. The following topics are discussed: pump flow physics, scale modeling of pump single-phase and two-phase operation, existing, empirical two-phase pump data, piping network flow regime characteristics, and unsteady and oscillatory pump/loop system characteristics. Emphasis is placed on the development of an understanding of two-phase pump behavior to determine the adequacy of scale model tests (both steady-state and transient) to predict full-size, primary coolant pump LOCA characteristics. GRA

N76-31540# Naval Surface Weapons Center, White Oak, Md.
BLAST AND FRAGMENTS FROM SUPERPRESSURE VESSEL RUPTURE Final Report
J. F. Pittman 9 Feb. 1976 133 p refs
(AD-A023288; NSWC/WOL/TR-75-87) Avail: NTIS CSCL 13/7

Seven spherical steel vessels, each with a volume of 1 cubic foot, were pressurized with argon until they burst. Airblast and

fragment parameters, were measured to aid in evaluating the hazards from high pressure vessel rupture. The vessels were designed to burst at either 15,000, 30,000, or 50,000 psi. Computer codes were developed to generalize and extend the experimental data. For bursts where internal gas temperatures are between 300 and 400K, increasing the vessel:s burst pressure beyond 15,000 psi does not increase airblast output. As temperatures inside the vessel are increased above 400K, higher pressure ruptures do increase airblast energy. As temperatures are increased further, the fill gas behaves ideally so that ideal gas assumptions can be used to set an upper limit to the energy output from high pressure vessel rupture. For a 15,000 psi rupture, ideal behavior is approached at temperatures above 1,300K. Each vessel separated at rupture into two hemispheres. These pieces were accelerated to velocities of about 300 ft/second; about half the calculated fragment velocities. GRA

N76-31541# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF GROOVED SOLID LUBRICATED BEARINGS Technical Report, Jul. 1972 - Jul. 1975

Ronald D. Dayton and Mac A. Sheets Feb. 1976 86 p refs (AF Proj. 3048)

(AD-A023473; AFAPL-TR-75-76) Avail: NTIS CSCL 13/9

This report describes an evaluation of solid lubricated bearings having grooved inner races. The intent of these grooves was to pump ambient air into the bearing, thus lowering stabilized operating temperatures and providing a means of heat dissipation. Nineteen series of tests were run with grooved and ungrooved bearings over a range of bearing loads and speeds. Bearing stabilization temperature and torque were monitored at each load-speed operating condition. Speeds were varied between 7500 and 30,000 RPM. Axial loads ranged between 75 and 150 pounds. Radial loads varied from zero to 75 pounds. Solid lubrication was provided using retainers of either a silver-mercury-teflon-molybdenum diselenide composite or a gallium-indium-tungsten diselenide compact. Bearing cage unbalance problems prevented a determination of groove effectiveness relative to cooler bearing operation. Speed had a predominant effect on bearing operating temperature and torque. The effects of bearing load and cage material were considerably less. In addition, five duration tests were conducted at 40,000 RPM. A bearing life of 14.5 hours was achieved at this speed with an axial load of 100 pounds. Author (GRA)

N76-31542# Michigan Univ., Ann Arbor. Highway Safety Research Inst.

BRAKING EFFICIENCY TEST TECHNIQUE Summary Final Report, Jul. 1973 - Nov. 1974

R. D. Ervin and C. B. Winkler Mar. 1976 35 p

(Contract DOT-HS-031-3-765)

(PB-252248/0; UM-HSRI-PF-74-13-2; DOT-HS-801-850) Avail: NTIS HC $4.00 CSCL 13F

A braking efficiency test technique provides a method whereby vehicle stopping performance can be specified, measured, and compared independently of the test surface. The method provides for an independent measure of the prevailing friction potential of the test surface. This measure is used to normalize the measured stopping performance of the test vehicle. A safety argument toward rulemaking as a potential adaptation to braking effectiveness requirements which currently exist is presented. A new mobile tire dynamometer, developed for this program, is discussed, as are the results of a demonstration test program. Author (GRA)

N76-31543# Calspan Corp., Buffalo, N.Y.

ROLLING RESISTANCE OF TIRES MEASURED UNDER TRANSIENT AND EQUILIBRIUM CONDITIONS ON CALSPAN'S TIRE RESEARCH FACILITY Final Report, Apr. 1975 - Jan. 1976

D. J. Schuring Mar. 1976 245 p refs

(Contract DOT-HS-4-00923)

(PB-251932/0; DOT-TSC-OST-76-9) Avail: NTIS HC $8.00 CSCL 13F

Rolling loss tests were performed on 31 different passenger and 4 light truck tires under transient and equilibrium conditions. The tests were designed to determine the effects of load, speed, inflation pressure, tire temperature, slip angle, torque, tire construction, aspect ratio and wheel diameter. In addition, the influences of road curvature (flat roadway, drum) and trip length on rolling resistance were investigated. The results are presented in tables and graphs. They are expressed in terms of 12 power loss descriptors (for each tire), stating initial values, equilibrium values, and distances required to achieve equilibrium, for rolling resistance, contained air temperature, tread surface temperature, and inflation pressure. Author (GRA)

N76-31544# Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.

METAL PIPE COUPLING STUDY Final Report

Sheldon M. Law Nov. 1975 67 p refs Sponsored by DOT (PB-252563/2; FHWA/LA/RR-95) Avail: NTIS HC $4.50 CSCL 13K

The Louisiana Department of Highways has been using the conventional test method AASHTO Designation: M 198 for the hydrostatic tests on corrugated metal culvert pipe. The test method for use on metal culvert pipe needed review and evaluation for possible changes or revisions, and a standard design was needed for the coupling systems. The specific aims of the study were: (1) to establish a standard design for the watertight coupling systems for the various kinds of metal culvert pipe and to evaluate the test method for determining watertight systems, (2) to evaluate seam connections of different type metal pipe, and (3) to evaluate some of the various coupling systems commercially available. GRA

N76-31545# Battelle Columbus Labs., Ohio.

TRANSPORTATION OF HIGHLY VOLATILE, TOXIC, OR CORROSIVE LIQUIDS BY PIPELINE Final Report, Apr. 1974 - Feb. 1976

D. E. Bearint, W. E. Berry, R. R. Fessler, D. N. Gideon, J. F. Kiefner, and G. L. Nessler 9 Feb. 1976 320 p refs

(Contract DOT-OS-40023)

(PB-253218/2; BATT-G-2845; DOT/OPSO-75/06) Avail: NTIS HC $9.75 CSCL 07A

The specific design, construction, operation, and maintenance practices of operators of pipeline systems transporting highly volatile, toxic, or corrosive liquids are examined. The primary method of information gathering was a questionnaire mailed to selected liquid pipeline companies. A literature survey was also conducted. Several liquid pipeline companies that responded to the questionnaire were subsequently contacted for additional information. While improvements are possible, the liquid pipeline companies appear to strive for a high level of integrity and reliability in all their pipelines, regardless of the commodity being transported. GRA

N76-31546# Bureau of Mines, Twin Cities, Minn. Mining Research Center.

EFFECT OF ENVIRONMENT ON FRICTION AND WEAR BETWEEN QUARTZ AND STEEL

Daryl R. Tweeton Mar. 1976 32 p refs Sponsored by the Dept. of Interior

(PB-252568/1; BM-RI-8124) Avail: NTIS HC $4.00 CSCL 08I

The Bureau of Mines conducted experiments to measure the influence of environment on the friction and wear of a steel-quartz system at several speeds and loads. In each test a quartz block was pressed against a rotating ring of low-carbon steel. Environments used were moist air, dry air, dry nitrogen, water, aqueous oleoylammonium acetate, and aqueous aluminum chloride ($AlCl_3$). The sliding speeds were 2.2, 13, and 33 cm/sec, and the loads were 6.8 and 13.6 kg. The coefficient of friction, the wear, and the roughness of the surfaces were measured and the wear debris was examined. Friction and wear are important in mining. In drilling and cutting rock, for example, it is desirable to minimize the wear of tools and any friction not contributing to rock fragmentation. The factors considered in this study were environment, speed of rubbing, the force (normal load) with which one surface was pressed against the other, and duration of rubbing. The effect of environment was emphasized. GRA

N76-31547# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

UNIVERSITY OF MICHIGAN RESEARCH APPLIED TO WATER JET AND CAVITATION CUTTING

F. G. Hammitt Nov. 1975 29 p refs Summary of the NSF Conf. at the Univ. of Missouri, Rolla, 1975
(Grant NSF GK-40130)
(PB-252379/3; UMICH-012449-26-I) Avail: NTIS HC $4.00 CSCL 20D

Cavitation research in the field of jet and droplet impact on materials are described. GRA

N76-32121 European Space Agency, Paris (France).
VIBRATION TESTS OF A STRUCTURE WITH DRY FRICTION
Rolland Dat, Raymond Tretout, Jean-Marie Lafont et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 94-106 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 169-174 (For availability see N76-32116 22-99)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-31548 Carnegie-Mellon Univ., Pittsburgh, Pa.
RELIABILITY MODELING OF SWITCHES AND SWITCHING STRATEGIES IN HYBRID REDUNDANCY Ph.D. Thesis
Ashok Ingle 1976 177 p
Avail: Univ. Microfilms Order No. 76-19327

A simple linear model for switch reliability is proposed. Partial switching is proposed as a means of attaining a trade-off between the switch reliability and the reliability associated with a switching strategy. A heuristic algorithm to arrive at a best spare assignment, as described by a switching matrix, for a given number of crosspoints is presented. The various techniques developed are applied to a switch design for a system with 5 voter positions and 3 spares. This analysis shows the number of switching states to be a good measure of switch complexity. The optimal switching matrices are found to be sparse, i.e., every spare is assigned to only a few voter positions. Thus, not only that the trade-off between the switch reliability and the reliability associated with the switching strategy is established, but for the type of design presented, the switch is shown to be a dominating factor. Dissert. Abstr.

N76-31549 New York Univ., N.Y. School of Engineering and Science.
SECOND ORDER AUTOREGRESSIVE MODEL APPLIED TO QUALITY CONTROL Ph.D. Thesis
Athanasios V. Vasilopoulos 1974 273 p
Avail: Univ. Microfilms Order No. 76-19613

In quality control the assumption is usually made that a time series x sub t is serially independent and normally distributed with mean (x bar prime) and standard deviation (beta prime). Under these assumptions, detection of shifts in the mean and standard deviation of observed quality characteristics of observed data usually follow the classical statistical quality control methodology. It is shown that, if the assumption of independence is not reasonable, corrections are in order. These corrections are found for the case where x sub t is a second order autoregressive model, by extending the classical quality control methodology. All the quality control factors for computing control limits for x bar and beta are derived under the assumption of a second autoregressive model. Dissert. Abstr.

N76-31550# Battelle Pacific Northwest Labs., Richland, Wash.
QUALITY CONTROL PROGRAM FOR 100 PERCENT INSPECTION USING NON-DESTRUCTIVE MEASUREMENTS
R. L. Hooper 1975 8 p refs Presented at 1st ERDA Statistical Symp., Los Alamos, N. Mex., 3 Nov. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5595; Conf-751113-10) Avail: NTIS HC $3.50

A quality control program is developed for the acceptance of individual items where 100 percent inspection is accomplished using a nondestructive measurement system. The program is a function of the measurement system's response to defects of a known size (standards), measurement precision, and a continuing plan for demonstrating that the measurement system is in control. Author (ERA)

N76-31551# Svenska Radio A.B., Stockholm (Sweden).
COMPARISON OF BEAM LEAD BONDED DEVICES TO THIN AND THICK FILM
Jan Johansson 10 Oct. 1975 33 p refs
(Contract ESTEC-1823/72-HP)
(ESA-CR(P)-818) Avail: NTIS HC $4.00

The characteristics of beam lead wobble bonded devices, bonded to thin- and thick film gold conductors on ceramic substrates are compared. The bond strength is considered in particular as a function of bond parameter settings. Author (ESA)

N76-31552# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF F-16 SUBSYSTEM OPTIONS THROUGH THE USE OF MISSION COMPLETION SUCCESS PROBABILITY AND DESIGNING TO SYSTEM PERFORMANCE/COST MODELS M.S. Thesis
Allan M. Doman and Alan G. Dunkerley Sep. 1975 258 p refs
(AD-A021263; GSM/SM/75D-13) Avail: NTIS CSCL 14/4

The Mission Completion Success Probability (MCSP) and Designing to System Performance/Cost (DSPC) models developed by the Office of the Assistant for Study Support provide the program manager with a quantitative method of analysis to aid in reliability management. The MCSP model calculates the probability of mission completion without an abort-causing failure of a subsystem. In addition, it produces a ranking of subsystems identifying those most likely to cause aborts, and performs a sensitivity analysis on non-redundant subsystems. The DSPC model analyzes combinations of subsystem options to define those options which lead to a higher MCSP at lower cost. Various optimal configurations are presented, allowing trade-offs of MCSP for different acquisition costs, logistic support costs, or total costs. When combined with the MCSP results, the DSPC model extends the methodology for applications to life cycle cost analysis. GRA

N76-31553# University of South Florida, Tampa. Dept. of Mathematics.
SENSITIVITY ANALYSIS OF THE BAYESIAN ESTIMATORS OF THE INTENSITY PARAMETER AND RELIABILITY FUNCTION OF THE POISSON FAILURE MODEL Interim Report
C. P. Tsokos and A. N. V. Rao 1976 33 p refs
(Grant AF-AFOSR-2711-74; AF Proj. 9769)
(AD-A020676; AFOSR-76-0111TR) Avail: NTIS CSCL 14/4

The Poisson failure model is studied under a stochastic behavior of the intensity parameter. Bayesian estimators of the life parameter and reliability function are summarized in which the natural conjugate is assigned as the prior distribution of the random parameter. The sensitivity of these estimators is obtained by assuming a true prior which is different from the assigned prior distribution. The authors employ the ratio of the average mean square errors as a measure of the robustness of the Bayes estimators when the true prior is different from the assumed natural conjugate. Both analytical and numerical results are given. GRA

N76-31554# University of South Florida, Tampa. Dept. of Mathematics.
ROBUSTNESS STUDIES FOR BAYESIAN DEVELOPMENTS IN RELIABILITY Interim Report
C. P. Tsokos and A. N. V. Rad 1976 41 p refs
(Grant AF-AFOSR-2711-74; AF Proj. 9769)
(AD-A020673; AFOSR-76-0108TR) Avail: NTIS CSCL 14/4

The Weibull probability density function is considered as a failure model under the influence of a stochastic scale parameter. Bayesian estimates of the scale parameter, reliability function and hazard rate are given for the conjugate prior distribution. A method for evaluating the robustness of the conjugate prior distribution which characterizes the behavior of the parameter is presented. A computer simulation to investigate the robustness

of the conjugate prior distribution with respect to six other prior probability distributions, namely, beta, Poisson, inverted gamma, truncated normal, log-normal and extreme value, were employed. These results indicate that there is a significant variation in the average mean squared error even when the priors were chosen so that their first two moments approximately agreed with that of the conjugate. GRA

N76-31555# University of South Florida, Tampa. Dept. of Mathematics.
COMPARISON OF BAYES ESTIMATES OF FAILURE INTENSITY FOR FITTED PRIORS OF LIFE DATA Interim Report
J. J. Higgins and C. P. Tsokos 1976 25 p refs
(Grant AF-AFOSR-2895-76; AF Proj. 9769)
(AD-A020674; AFOSR-76-0109TR) Avail: NTIS CSCL 14/4

The number of times a piece of equipment fails in a fixed time T is assumed to have the Poisson sampling density. The parameter of interest is the failure intensity, the reciprocal of the mean time between failures. The loss function of interest is the squared error loss function. A robustness study of Bayes estimates of the failure intensity is carried out. The Bayes estimate of the failure intensity for a general prior is expressed in terms of the marginal density of the observed number of failures, and implications for the robustness of Bayes estimates for fitted priors is discussed. Numerical examples are given for the gamma, uniform, and inverted uniform priors which are fitted to actual failure data. In addition to comparisons among the Bayes estimates of failure intensity for fitted priors, the Bayes estimate under the fitted gamma prior is compared to the corresponding estimates under other, subjectively chosen, gamma priors. GRA

N76-31556# University of South Florida, Tampa. Dept. of Mathematics.
BAYESIAN ANALYSIS OF THE WEIBULL FAILURE MODEL UNDER STOCHASTIC VARIATION OF THE SHAPE AND SCALE PARAMETERS Interim Report
C. P. Tsokos and A. N. V. Rao 1976 26 p refs
(Grant AF-AFOSR-2895-76; AF Proj. 9769)
(AD-A020675; AFOSR-76-0110TR) Avail: NTIS CSCL 14/4

In the last five or six years there has been a considerable amount of rising interest in the Bayesian approach to reliability. To a practicing reliability scientist, such an approach would seem quite appealing because it provides a way for the formulation of a distributional form of the unknown parameters inherent within the failure model, based on prior convictions or information available to him. Evans and Drake have given an excellent account for the use of Bayesian theory in reliability. Furthermore, from a practical point of view, Feduccia states that employing the reliability prediction and its associated measure of uncertainty, the coefficient of variation as the 'prior' in a Bayesian setting makes sense. The aims of the present study is to investigate the behavior of a two parameter failure model subject to both behaving as random variables. GRA

N76-31557# Wisconsin Univ., Madison. Mathematics Research Center.
BAYESIAN ANALYSIS OF RELIABILITY IN MULTICOMPONENT STRESS-STRENGTH MODELS
Norman R. Draper and Irwin Guttman Jan. 1976 38 p refs
Sponsored in part by Natl. Res. Council of Canada, Ottawa
Prepared in cooperation with Toronto Univ.
(Contracts DAAG29-75-C-0024; N00014-67-A-0128-0017)
(AD-A022746; MRC-TSR-1583) Avail: NTIS CSCL 14/4

A Bayesian treatment is given of the problem of inference about the reliability of a multicomponent stress-strength system which functions if s or more of k identical components simultaneously operate. All stresses and strengths are assumed to be independent, exponentially distributed random variables. Exact and approximate asymptotic posterior distributions for the reliability are derived, and the various results are illustrated by numerical examples. Typically, components are mass produced and a sample of strengths can be generated from laboratory load tests on a random sample of the components. Also, the data of stress can be obtained from a simulation of conditions for operating the system. Thus, such data may be used for inference on the reliability of any s out of k system. It is not necessary to construct and test a complete system for each contemplated choice of s and k. GRA

N76-31558# Syracuse Univ., N.Y.
MATHEMATICAL METHODS OF RESOURCE ALLOCATION FOR OPTIMIZING RELIABILITY Final Technical Report, Jul. 1974 - Sep. 1975
John E. Biegel Griffiss AFB, N. Y. RADC Feb. 1976 55 p refs
(Contract F30602-71-C-0312)
(AD-A022669; Rept-76-3; RADC-TR-76-38) Avail: NTIS CSCL 14/4

The literature was searched to find algorithmic techniques for resource allocation to maximize reliability or to minimize cost (in terms of volume, weight, dollars, etc.) for a minimum level of reliability. One has to conclude that only the simplest of models have been investigated. Most papers deal with the simple series-parallel circuit with a single input and a single output. It appears as though multiple goal programming may be a useful technique. The biggest need seems to be a nonenumerative method for calculating the reliability of a multicomponent system. GRA

N76-31559# Hughes Aircraft Co., Culver City, Calif. Data Systems Div.
RELIABILITY EVALUATION OF PROGRAMMABLE READ-ONLY MEMORIES (PROMs) Final Technical Report, 4 Mar. 1974 - 3 Mar. 1975
T. M. Donnelly, W. W. Powell, C. M. Dewitt, III, D. R. Jerand, and M. Penberg Griffiss AFB, N. Y. RADC Feb. 1976 283 p
(Contract F30602-74-C-0156; AF Proj. 5519)
(AD-A022667; RADC-TR-75-278) Avail: NTIS CSCL 09/2

The primary objectives of this study were to: (1) assess unique factors affecting the reliability of 1024-bit open collector programmable read-only memories (PROMs) from three technologies, i.e., nichrome fusible links, titanium-tungsten fusible links and avalanche induced migration (AIM) or 'blown dioxe' technology; (2) recommend programming, testing and screening guidelines for the subject PROMs; and (3) develop a failure prediction technique for the subject PROMs. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-31560 Texas Technological Univ., Lubbock.
FINITE ELEMENT ANALYSIS OF THE BEHAVIOR OF NONLINEAR SOIL CONTINUA INCLUDING DILATANCY Ph.D. Thesis
Dorairaja Raghu 1975 144 p
Avail: Univ. Microfilms Order No. 76-17760

The behavior of both dense and loose sand was first investigated, when a vertical steel plate is pushed into it. A new dilation finite element model based on variational principles was developed to study the effects of shear dilatancy in the sand. The second problem deals with a loaded footing resting on soft clay. An incremental octahedral stress approach with two variable elastic constants is used in the nonlinear analysis of these problems. The change in geometry of the soil continuum due to large deformations is taken into consideration by updating the geometry during every increment. The incremental strain tensor in each element is decoupled into elasto plastic and dilatory components. The elasto plastic stress-strain relations are developed from conventional test results and the dilatory strain components occur in addition to the elasto plastic strain components. The results indicate that it is possible to simulate realistically the displacement patterns and the propagation of plastic flow occurring in the soil. Dissert. Abstr.

N76-31561 Wisconsin Univ., Madison.
OPTIMUM DESIGN OF TRUSSES AND MULTISTORY

FRAMES Ph.D. Thesis
Mohamad Sahari Besari 1975 348 p
Avail: Univ. Microfilms Order No. 75-28784

A procedure of nonlinear optimum design of trusses and multistory frames is presented. Computer programs for optimum design of determinate and indeterminate trusses and multistory frames are included. Trusses and frames with prescribed geometry, subjected to multiple loading conditions, are optimized to satisfy a number of limitations on direct and buckling stresses. The objective of design is to find a satisfactory structure with the least material weight or volume. The optimum structure is obtained by applying the sequential unconstrained minimization technique. The design procedure is an iterative process, carried out on a digital computer. The final optimum structure is approached from the interior of the feasible region. Hence feasible intermediate results, i.e., satisfactory structure are produced in the design process. Dissert. Abstr.

N76-31562* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLANGED MAJOR MODULAR ASSEMBLY JIG Patent
Meyer M. Gilman, inventor (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Issued 31 Aug. 1976 11 p Filed 25 Oct. 1974 Supersedes N75-11351 (13 - 02, p 0177) Sponsored by NASA
(NASA-Case-MSC-19372-1; US-Patent-3,977,147; US-Patent-Appl-SN-517995; US-Patent-Class-52-648; US-Patent-Cfass-52-749; US-Patent-Class-52-637; US-Patent-Class-52-236; US-Patent-Class-52-745; US-Patent-Class-52-726; US-Patent-Class-52-651; US-Patent-Class-29-526; US-Patent-Class-182-178; US-Patent-Class-29-467) Avail: US Patent Office CSCL 13M

Weldless methods and means are described for securing flanges to the projecting ends of an unmachined box beam framework in such a manner that the flanged structure may be reused without modification. And one framework may be readily assembled to another by simply matching the flanges together and passing connecting members between performed holes in the structures. Official Gazette of the U.S. Patent Office

N76-31563+ Royal Aircraft Establishment, Farnborough (England).
BIBLIOGRAPHY, WITH SOME ABSTRACTS, ON FINITE ELEMENT METHODS OF DETERMINING STRESS INTENSITY FACTORS
R. W. Slaney, comp. Jan. 1976 50 p refs Presented at the RAE/SBAC Fracture Mech. Forum, Farnborough, Engl., 25-26 Nov. 1975
(RAE-Lib-Bib-352; BR51156) Copyright. Avail: NTIS HC $4.00

This bibliography lists material known to RAE(F) library; and material announced in STAR, IAA, GRA, and Applied Mechanics Reviews from 1971 to date. Relevant material is also listed in Nuclear Science Abstracts and Engineering Index, but this is not included. Abstracts were included, and sometimes edited, where available. Works known to employ special treatment at the crack tip stresses are listed separately from those employing conventional finite element analyses. Author (ESA)

N76-31564# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
SCATTERING OF A COMPRESSIONAL WAVE FROM A CYLINDRICAL DEFECT
K. Sittel and J. Palchefsky, Jr. 19 Dec. 1975 44 p refs
(Contract NAS1-11867)
(Doc-75SDR037) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

The displacement potential for a plane wave reflected from a cylindrical inclusion within an elastic medium is determined. The plane compressional wave originates in the water filled portion of two half spaces having a plane interface. The cylinder is located with its axis parallel to the interface and normal to the impinging wavefront. The scattering problem is solved separately from the refraction problem by stipulating that the cylinder/interface distance is larger than the pulse length. The scattered compressional wave is expressed as a set of cylindrical waves originating from the cylinder axis and refracted into the water. This approach reduces the problem to the complex integration of a Fourier Integral. A detailed exposition of the integration by the path of steepest descent is provided. The equation for the saddle point, as well as a proof for its uniqueness, is developed so that the integral can be easily evaluated by the computer. Author

N76-31565# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EFFECT OF THE LOADING SEQUENCE AND OF OTHER FACTORS ON THE DAMAGE SUM IN FATIGUE
Alfred Buch May 1976 44 p refs
(TAE-281) Avail: NTIS HC $4.00

The effect of the loading sequence on the damage sum and on the remaining fatigue life was investigated on notched aircraft material specimens in rotating-bending and tension-compression, pulsating-tension and combined loading spectra. A normal sequence effect was observed in the cases of rotating-bending, tension-compression, and pulsating tension combined with tension-compression in a block test. In all these cases the damage sum was smaller for a decreasing loading than for the corresponding increasing loading spectrum, which may be explained qualitatively by the nonlinear stress-dependent damage cumulation. The reversed effect (damage sum higher for decreasing than for increasing loading sequence) was observed in two-step pulsating-tension tests and may be related to the influence of compressive residual stresses. The loading sequence effect was reversed for lugs and the damage sum always exceeded 1 for this component. Author

N76-31566# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ESTIMATION OF FATIGUE PROPERTIES OF AIRCRAFT LUGS WITH INTERFERENCE FITS
Alfred Buch Jun. 1976 36 p refs
(TAE-290) Avail: NTIS HC $4.50

Fatigue tests were carried out on 2024-T3 lugs of different shapes. Various methods for evaluation of the effect of interference fit were checked. Size corrections, net area correction factors and N = const lines were obtained for interference fit lugs. Tabulated data from the tests are given. Author

N76-31567*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUSTAINED LOAD CRACK GROWTH DESIGN DATA FOR Ti-6Al-4V TITANIUM ALLOY TANKS CONTAINING HYDRAZINE
J. C. Lewis and J. T. Kenny (Martin Marietta Aerospace) 15 Sep. 1976 24 p refs
(Contract NAS7-100)
(NASA-CR-147976; JPL-TR-32-1606) Avail: NTIS HC $3.50 CSCL 13M

Sustained load crack growth data for Ti-6Al-4V titanium alloy in hydrazine per MIL-P-26536 and refined hydrazine are presented. Fracture mechanics data on crack growth thresholds for heat-treated forgings, aged and unaged welds, and aged and unaged heat-affected zones are reported. Fracture mechanics design curves of crack growth threshold stress intensity versus temperature are generated from 40 to 71 C. Author

N76-31568*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ON THE ELASTIC STABILITY OF SHELLS Final Report
Wilfred H. Horton Jun. 1976 86 p refs
(Grant NGL-11-002-096)
(NASA-CR-148484) Avail: NTIS HC $5.00 CSCL 13M

A synopsis of a series of investigations into the instability of axially compressed cylindrical shells is given. The objective of the research, which was made with models, was to devise a technique of nondestructive evaluation. The results show that, with models at any rate, success was achieved. Probing methods which can be used to determine the locations of weakness and the pertinent instability load levels were devised. The research on large scale shells was undertaken to determine the critical loads under as uniform a circumferential distribution of axial

compressive force as possible. It is clear from the results presented that this objective was met. Author

N76-31569# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NO. 5, MAY 1976
Henry C. Pusey, ed. and Robert Belsheim, ed. May 1976 80 p refs
(AD-A025370) Avail: NTIS HC $5.00

Shell response to acoustic shocks, approximate methods for computing eigenelements of integral and differential linear operators, and vibrations of disordered structured systems are discussed. For individual titles, see N76-31570 through N76-31572.

N76-31570 Polytechnic Inst. of New York, Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.
RESPONSE OF SHELLS TO ACOUSTIC SHOCKS
J. M. Klosner *In* Shock and Vibration Inform. Center Shock and Vibration Digest, Vol. 8, No. 5, May 1976 May 1976 p 3-13 refs (For availability see N76-31569 22-39)

The shock response and stability of submerged shells and other dynamic loads in a fluid of infinite expanse are investigated. A system of structural and fluid field equations along with their interrelationships were solved simultaneously. Various approximations are discussed in detail. Fluid decoupling schemes were examined and a doubly asymptotic approximation was used to decouple the fluid field. Results indicated that the value of the instability pressure was extremely sensitive to the transition time, after which incompressibility was assumed. B.B.

N76-31571 Grenoble Univ. (France).
APPROXIMATE METHODS FOR COMPUTING THE EIGENELEMENTS OF INTEGRAL AND DIFFERENTIAL LINEAR OPERATORS **c64**
Francoise Chatelin *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 5, May 1976 May 1976 p 15-19 refs (For availability see N76-31569 22-39)

Various convergence methods available to solve approximative eigenvalue problems for integral or differential operators are reviewed. Computable error bounds of eigenelements are given. B.B.

N76-31572 State Univ. of New York, Buffalo.
VIBRATION OF DISORDERED STRUCTURAL SYSTEMS
T. T. Soong and F. A. Cozzarelli *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 5, May 1976 May 1976 p 21-35 refs (For availability see N76-31569 22-39)

Vibration studies concerned with disordered lumped parameter and distributed parameter structural systems are reviewed. The term disorder is used to mean randomness of the parameter values. Probability distributions of the parameters can be constructed through observation and experiment and are assumed specified either directly or indirectly through a dependence on other specified parameters. Author

N76-31573# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NO. 6, JUNE 1976
Henry C. Pusey, ed. and Robert Belsheim, ed. Jun 1976 96 p refs
(AD-A025904) Avail: NTIS HC $5.00

Vibration control of viscoelastic materials and the optimal control design of turbine blades are considered. For individual titles, see N76-31574 through N76-31575.

N76-31574 Indian Inst. of Tech., New Delhi. Dept. of Mechanical Engineering.
VIBRATION CONTROL WITH VISCOELASTIC MATERIALS
B. C. Nakra *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 6, Jun. 1976 Jun. 1976 p 3-12 refs (For availability see N76-31573 22-39)

Suitable arrangements of elastic and viscoelastic materials are being used in vibration control. The viscoelastic materials are so arranged that they are subjected to deformations when exposed to vibration. Some high molecular weight polymers exhibit viscoelastic properties. The properties of viscoelastic materials are related to damping effectiveness and various arrangements. The effectiveness of unconstrained damping on structures subjected to random and shock excitations are evaluated. The use of viscoelastic damped substructures for supporting aircraft and missile components, as well as concrete structures is reported. S.M.

N76-31575 Loughborough Univ. of Technology (England).
TWO-POINT BOUNDARY VALUE PROBLEMS IN THE OPTIMAL CONTROL DESIGN OF TURBINE BLADES
B. M. E. deSilva, D. R. Green, and G. N. C. Grant *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 6, Jun. 1976 Jun. 1976 p 25-33 refs (For availability see N76-31573 22-39)

Methods for handling some nonlinear differential equations in the complex domain arising in the optimization of turbine blades are described. The optimal control formulations are based on a combination of second variation methods and quasilinearization of the differential equations. They are characterized by inhomogeneous matrix differential equations of the Ricatti type and generation of minimizing control functions to be incorporated into the linearized state and adjoint equations. A discussion of some computational difficulties encountered in the solution of these equations are included. Author

N76-31576# Catholic Univ. of America, Washington, D.C.
EXPERIMENTAL DETERMINATION OF STRAINS AT HIGH TEMPERATURE
A. J. Durelli and J. Buitrago Oct. 1975 75 p refs
(Contract W-7405-eng-26)
(TID-26977) Avail: NTIS HC $4.50

Great technical difficulties have to be overcome to determine strain fields when loaded bodies are subjected to temperatures of the order of 1100 F for long periods of time. Progress made in the development of three methods used, moire, grids, and indented dots is summarized. The strain-analyzed specimen is an in-plane loaded stainless steel plate with a central hole. Loads were sufficiently large to produce elastic, plastic, and viscoelastic deformations. Sufficient results were obtained to show the feasibility of the approaches followed and to be in a position to verify independent structural solutions, but the precision of the determinations and the time required for the evaluation are considered not satisfactory. Some details of the techniques employed and recommendations to improve them are included. Author (ERA)

N76-31577# Cornell Univ., Ithaca, N.Y.
CREEP ANALYSIS OF STRUCTURES USING A NEW EQUATION OF STATE TYPE CONSTITUTIVE RELATION
Virendra Kumar and S. Mukherjee Sep. 1975 40 p refs Sponsored by ERDA
(COO-2733-2) Avail: NTIS HC $4.00

A computational scheme is presented for the analysis of a certain class of problems involving creep of metals at elevated temperatures. The high temperature nonelastic behavior of materials is assumed to obey a new mechanical equation of state type constitutive relation. Results are compared qualitatively with the results of classical strain hardening and time hardening theories of creep. The proposed computational scheme is found to be very efficient from the view point of both computational time and effort. In regard to the equation of state approach, it is found that in addition to the general features of these classical creep theories, it is also capable of taking into account the effect of prior deformation history on subsequent creep behavior by simply specifying the initial distribution of a single state variable called hardness. Author (ERA)

N76-31578# Rochester Univ., N.Y.
MATERIALS AND MECHANICS OF RATE EFFECTS IN BRITTLE FRACTURE Progress Report, Oct. 1974 - Oct. 1975
S. J. Burns Oct. 1975 6 p refs
(Contract E(11-1)-2422)
(COO-2422-04) Avail: NTIS HC $3.50

The critical stress intensity factors for propagating cracks, K/sub !D/, was experimentally found to decrease with increasing

crack velocity. K/sub ID/ was measured using rapidly wedged double cantilevered beam specimens. The crack length versus time was continuously recorded using electro potential techniques. The specimens were fractured at temperatures well below the britte to ductile transition temperature. The analysis of fully dynamic crack propagation in double torsional beam specimens was solved in closed analytic form. The solutions for rotational rate loading and for constant applied torque predict constant crack velocity. The measurements of static, dynamic loading and propagating crack, stress intensity factors establishes that rate is an important variable in specifying the stress intensity factor for fracture. Author (ERA)

N76-31579# Princeton Univ., N.J. Plasma Physics Lab.
PDX VACUUM VESSEL STRESS ANALYSIS
Z. D. Nikodem 1975 9 p refs Presented at IEEE 6th Symp. on Engineering Problems of Fusion Research, San Diego, Calif., 17 Nov. 1975
(Contract G(11-1)-3073)
(CONF-751125-106) Avail: NTIS HC $3.50

A stress analysis of PDX vacuum vessel is described, and the summary of results is presented. The vacuum vessel is treated as a toroidal shell of revolution subjected to an internal vacuum. The critical buckling pressure is calculated. The effects of the geometrical discontinuity at the juncture of toroidal shell head and cylindrical outside wall, and the concavity of the cylindrical wall are examined. An effect of the poloidal field coil supports and the vessel outside supports on the stress distribution in the vacuum vessel is determined. A method evaluating the influence of circular ports in the vessel wall on the stress level in the vessel is outlined. Author (NSA)

N76-31580# Blume (John A.) and Associates Research Div., San Francisco, Calif.
DYNAMIC RESPONSE CHARACTERISTICS OF REINFORCED CONCRETE STRUCTURES
S. A. Freeman, C. K. Chen, and R. M. Czarnecki 1976 11 p refs Presented at the ASCE/EMD Specialty Conf. on Dynamic Response of Structures, Los Angeles, 30 Mar. 1976 Sponsored by ERDA
(CONF-760307-3) Avail: NTIS HC $3.50

A program of vibration investigations of two identical 4-story reinforced concrete test structures which were constructed in 1965 at the Nevada Test Site is summarized. These investigations were conducted as part of a structural response program associated with the detonation of underground nuclear explosions. The structures were built to obtain experimental data on the dynamic response characteristics of high-rise concrete buildings, ultimately leading to the development of improved techniques for predicting damage and response to ground motion. Information is included on the four-story test structure, test equipment and methods, methods of response data analysis, and comparison of calculated and measured dynamic response of reinforced concrete structure. The results showed that conventional modeling techniques could be used to accurately predict response in the elastic range. NSA

N76-31581# Bettis Atomic Power Lab., West Mifflin, Pa.
ANALYSIS OF IODINE STRESS CORROSION CRACKING OF ZIRCALOY-4 TUBING
P. H. Kreyns, G. L. Spahr, and J. E. McCauley Feb. 1976 31 p refs
(Contract E(36-1)-GEN-14)
(WAPD-TM-1203) Avail: NTIS HC $4.00

A fracture mechanics approach to interpreting iodine-vapor stress corrosion cracking (SCC) in unirradiated Zircaloy-4 tubing is presented in which crack velocities are related to the fourth power on the stress intensity factor, K/sub I/. The crack growth power law on K/sub I/ is shown to predict well the time-to-failure in internally pressurized Zircaloy-4 tubing at 360 and 400 C reported by Busby, Tucker and McCauley. The temperature dependency on iodine stress corrosion cracking in Zircaloy can be described by an Arrhenius-type equation in which the activation energy Q for recrystallized and cold-reduced Zircaloy was determined to be 42.9 kcal/mole and 35.9 kcal/mole, respectively. It is concluded that the geometry of the initial surface flaw, through its attendant elastic stress field, is directly responsible in controlling the SCC time-to-failure cold working having a relatively small effect on increasing the susceptibility to SCC. NSA

N76-31582# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
REVIEW OF AERONAUTICAL FATIGUE INVESTIGATIONS IN THE NETHERLANDS DURING THE PERIOD APRIL 1973 - MARCH 1975
J. Schijve Apr. 1975 55 p refs Presented at the 14th ICAF Conf., Lausanne, Switz., 28-30 May 1975
(NLR-MP-75011-U) Avail: NTIS HC $4.50

Contributions from the National Aerospace Laboratory (NLR), the Aerospace Department of the Delft University of Technology and the Fokker Aircraft Industries are reviewed. The main topics include loads, flight simulation testing procedures, crack initiation and propagation, fatigue tests on notched specimens and panels, residual strength, materials evaluation, fractography, fatigue crack growth, cumulative fatigue damage, F-28, VFW-614, airbus A 300 B, and general investigations. Author (ESA)

N76-31583# Nederlands Scheeps-Studiecentrum TNO, Delft. Scheepsbouw Afdeling.
FULL-SCALE MEASUREMENTS OF STRESSES IN THE BULKCARRIER M.V. OSSENDRECHT. PART 2: THE SPECTRAL ANALYSIS, THE DISTRIBUTION OF AMPLITUDES, THE DISTRIBUTION OF HEIGHTS, THE SQ CHI TEST
F. X. P. Soejadi May 1975 39 p refs
(Rept-204-S-Pt-2; TDCK-66811-Pt-2) Avail: NTIS HC $4.00; Ned. Scheepsstudiecentrum TNO, Delft DFI.10

To find corroboration of the validity of predictions obtained along theoretical methods, full scale measurements of sea wave induced stresses were carried out on the bulkcarrier Ossendrecht. Since the measurements concern a statistical variable, the reduction and analysis were performed according to the theory of statistics. Data processing and the theory concerned is treated viz. the characteristics of the spectra, the distribution of amplitudes, the distribution of all heights (with and without zero-crossing), the distribution of heights with zero-crossing only, and the significance of the sq Chi test. One of the main conclusions is that the sq Chi test in general resulted in satisfactory agreement of the distributions of heights with zero-crossing and the Rayleigh distribution law. However, the connection with the spectral characteristics is loosened by neglecting the heights without zerocrossing. Since stress-response to waves was found to be broad-banded, the ideal assumption of 8 m sub zero = E (the mean square of the height values) is not fulfilled. Author (ESA)

N76-31584# Nederlands Scheeps-Studiecentrum TNO, Delft. Scheepsbouw Afdeling.
STRESS ANALYSIS OF DETAILSTRUCTURES OF A THIRD GENERATION CONTAINERSHIP
W. TenCate and A. W. VanBeek (Inst. TNO for Mech. Construct.) Dec. 1974 17 p refs
(Rept-210-S; TDCK-67274) Avail: NTIS HC $3.50; Ned. Scheepsstudiecentrum TNO, Delft DFI. 10

A finite element analysis of the stress distribution in three heavily loaded hatchcorners of a third generation containership is presented. The hatchcorners, located near the engine room and at intersections of transverse boxgirders with the main longitudinal bulkhead, were investigated. The stresses were calculated for two loading conditions, corresponding to still water bending and torsional loading of the ship. The boundary conditions for the structural details were derived from an overall finite element analysis of the containership. Author (ESA)

N76-31585# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
FRACTURE MECHANICS INVESTIGATIONS OF CRACKS IN ROTATING DISCS
M. Wenk, J. Beinert, and J. G. Blauel Jul. 1975 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(IFKM-WB-3/75) Avail: NTIS HC $4.50

Stress intensity factors K were determined both analytically and by using a photoelastic method for the simple case of a rotating solid disk containing radial cracks. Good agreement was

found not only between the calculated and the experimental K-factors but also between the static and the dynamic toughness values determined in ASTM tension tests and spin burst tests. This confirms the applicability of linear elastic fracture mechanics and the validity of the brittle fracture criterion. In addition, the use of the simple superposition procedure is justified as a basis for the analysis. The possibilities and limitations of applying these results to practical situations are considered. Author (ESA)

N76-31586# Royal Aircraft Establishment, Farnborough (England).
STRESS INTENSITY FACTORS FOR CRACKS IN STIFFENED SHEETS
D. P. Rooke, D. J. Cartwright, and Elizabeth Davis Jul. 1975 27 p refs
(RAE-TR-75072; BR48362) Avail: NTIS HC $4.00

The compounding technique of obtaining approximate solutions for stress intensity factors was applied to periodically stiffened sheets containing cracks. The basic compounding method requires a simple modification if the stiffener actually crosses the crack. Probable errors in compounded results are shown to be small (a few percent) by comparing some compounded results with known results. The stress intensity factor is calculated for a crack located asymmetrically between stiffeners. Author (ESA)

N76-31587# Royal Aircraft Establishment, Farnborough (England).
STRESS INTENSITY FACTORS FOR RADIAL CRACKS IN DISCS
D. P. Rooke Oct. 1975 26 p refs
(RAE-TR-75118; BR49563) Avail: NTIS HC $4.00

Stress intensity factors for radial cracks in disks were derived using integral transform techniques. Three types of loading were considered, constant pressure on the crack faces, body forces due to rotation of the disk and forces acting on the edge of the disk. The results are presented graphically. Author (ESA)

N76-31588# Naval Construction Research Establishment, Dunfermline (Scotland).
SPAN: A COMPUTER PROGRAM FOR STATIC AND DYNAMIC ANALYSIS OF STIFFENED PLATES AND GRILLAGES
G. C. Mitchell, J. D. Clarke, and C. S. Smith Feb. 1976 67 p refs
(NCRE/R630; BR50857) Avail: NTIS HC $4.50

A computer code for the static and dynamic analysis of flat plate grillages is described. The code uses a finite element displacement method incorporating a geometric stiffness matrix to calculate the response to static, cyclic, or transient loads. Natural frequencies and buckling loads can also be calculated. A full input description is given including a simplified data generation facility for regular orthogonal grillages. Input and output for some representative sample problems are included.
Author (ESA)

N76-31589# European Space Agency, Paris (France).
EFFECT OF CRACK LENGTH ON THE FRACTURE TOUGHNESS OF CT SPECIMENS
Dietrich Munz Feb. 1976 31 p refs Transl. into ENGLISH of 'Einfluss der Risslaenge auf die Risszaehigkeit bei CT-Proben', DFVLR, Cologne Report DLR-FB-75-63, 16 Sep. 1975 Original German report available from DFVLR, Cologne DM 13.60
(ESA-TT-270; DLR-FB-75-63) Avail: NTIS HC $4.00

The effect of crack length on fracture toughness and the crack growth resistance curve were determined for CT specimens of the titanium alloy Ti-6Al-4V. The crack growth resistance curve rises steeply up to a crack extension of 0.4 mm. It is possible to determine fracture toughness according to the ASTM standard method with sufficient accuracy in a range 0.3 smaller than a/W smaller than 0.7. It is possible to evaluate the crack extension from the deviation from the linear part of the load crack opening displacement curve or from the slope of the unloading curve for delta a greater than 0.5 mm with an accuracy of about 20 %. Author (ESA)

N76-31590# European Space Agency, Paris (France).
CALCULATED RESTITUTION OF STRUCTURAL NATURAL MODES FROM NON-APPROPRIATED EXCITATIONS
Xuan Thanh Nguyen May 1976 58 p refs Transl. into ENGLISH of 'Restitution par Calcul des Modes Propres a Partir d'Excitations Non Appropriees', ONERA, Paris Report ONERA-NT-1975-9, 1975
(ESA-TT-295; ONERA-NT-1975-9) Avail: NTIS HC $4.50

After a review of the theoretical bases and experimental methods used for the ground vibration test, the fundamental problem of determining the modal data is discussed. The proposed method, which does not require the appropriation of the excitation forces, makes it possible to determine the vibratory characteristics of a linear, weakly damped structure from scannings around the resonance frequency of each mode with different configurations of excitation forces. It is first demonstrated that around the resonance frequency of a natural mode, and under an excitation appropriated to this mode, the significant points of the structure vibrate in phase; the determination of the whole set of modal data as well as of the configuration of appropriated excitation forces is then obtained. The results calculated in this manner are perfectly comparable to those obtained with a test performed with conventional isolation processes. Author (ESA)

N76-31591# European Space Agency, Paris (France).
DESIGN FOR FATIGUE CONDITIONS
R. Somoza-Soler Jun. 1976 128 p refs Transl. into ENGLISH of 'Influencia del Proyecto y Fabric. en la Resistencia a la Fatiga de Estructuras y Sistemas Mecan.', Escuela Tec. Super. de Ing. Ind., Madrid Report TR-2-62, 1962
(ESA-TT-301; TR-2-62) Avail: NTIS HC $6.00

The main factors relevant to fatigue failures regarding materials, fabrication, and design practices are reviewed. Each aspect is discussed in sufficient depth to understand the reasons for its applicability under different conditions, designer. The practices are summarized as a list of easy to read, easy to find, recommendations. They are also presented in tabular form.
Author (ESA)

N76-31592# Army Construction Engineering Research Lab., Champaign, Ill.
OPERATIONS GUIDE: WATER AND CEMENT CONTENT OF FRESH CONCRETE Final Report
P. A. Howdyshell Feb. 1976 32 p refs
(DA Proj. 4A7-62719-AT-05)
(AD-A022697; CERL-TR-M-177) Avail: NTIS CSCL 13/3

This operations guide provides information needed to set up and operate the Kelly-Vail (K-V) system for determining water and cement content of fresh concrete. The guide describes the K-V system's capabilities, limitations, and accuracy; and details the required equipment, reagents, and procedures. A guide for analyzing test results and a description of two mobile field units are presented. The system's capability to estimate potential concrete strength is also discussed. GRA

N76-31593# Ammann and Whitney, New York.
OVERTURNING AND SLIDING ANALYSIS OF REINFORCED CONCRETE PROTECTIVE STRUCTURES
William Stea, Samuel Weissman, and Norval Dobbs Dover, N. J. Picatinny Arsenal Feb. 1976 293 p refs
(Contract DAAA21-75-C-0222)
(AD-A022619; PA-TR-4921) Avail: NTIS CSCL 13/13

This report presents design procedures and the computer program written to implement them for determining the gross motions of protective structures subjected to blast effects of high explosive detonations. These procedures are intended to supplement the design methods of the tri-service design manual 'Structures to Resist the Effects of Accidental Explosions' (TM 5-1300). The material presented includes dynamic analysis techniques for determining the gross motions of the structure on its supporting soil, methods for computing the time history of the blast load on the structure, and criteria and procedures for designing the foundation of the structure. A system of classification of various soils is given together with a tabulation of critical soil properties. Documentation of the computer program is provided by means of descriptions of the required input parameters, definitive illustrations of the coded input card formats, illustrations of input deck structures, the FORTRAN listing for the CDC 6600 computer, and sample problems. Author (GRA)

N76-31594# California Univ., Los Angeles. Dept. of Mechanics and Structures.

OPTIMUM DESIGN OF SUBMERGED CYLINDRICAL SHELLS SUBJECTED TO DYNAMIC LOADINGS

R. B. Nelson, L. P. Felton, and L. A. Schmit, Jr. Nov. 1975 41 p refs

(Contract N00014-69-A-0200-4048)

(AD-A021248; UCLA-ENG-7587) Avail: NTIS CSCL 20/11

This report presents a procedure for the optimum design of a submerged T-ring stiffened cylindrical shell subjected to a specified harmonic excitation and external pressure. Three different design objectives can be investigated: (1) minimum structural mass, (2) minimum structural response and (3) minimum of a linear combination of structural mass and structural response. The design variables are shell thickness, T-web depth and thickness, T-flange width and thickness, and (uniform) stiffener spacing. The design constraints are on geometric admissibility, in vacuo natural frequencies of the shell, shell buckling, and on internal stresses. Numerical studies indicate the necessity of constraining the structural mass of the cylinder if minimum structural response is the design objective, and constraints must be imposed on both structural response and maximum structural mass when the combined design objective is employed. GRA

N76-31595# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

JOINTS IN LARGE PANEL PRECAST CONCRETE STRUCTURES

Una Irelan Zeck Jan. 1976 178 p refs

(Grant NSF ENV-75-03778)

(PB-252852/9; MIT-CE-R76-16; Rept-1) Avail: NTIS HC $7.50 CSCL 13C

The presence of joints may be a reason for concern in seismic regions or progressive collapse situations. The forces which various loading conditions require joints to transfer and the means by which they may do so are investigated. Some typical joint types (including plain and reinforced concrete, post-tensioned, welded and bolted) have been identified. Available in formation on the behavior of various joint types has been studied, and, based on this, the potential behavior of joints under ultimate loads, including reversals, and their posible influences on structural performance are discussed. GRA

N76-31596# New York State Dept. of Transportation, Albany. Engineering Research and Development.

AN INVESTIGATION OF CRACKING OF SLAG-AGGREGATE CONCRETE PAVEMENTS Final Report

Duane E. Amsler, William P. Chamberlin, and Jerry K. Jaqueway Oct. 1975 19 p refs

(PB-252388/4; NYSDOT-ERD-75-SR-34) Avail: NTIS HC $3.50 CSCL 13C

The frequency of cracking in some western New York pavements containing blast furnace slag coarse aggregate and in others containing other coarse aggregates was investigated. Cracking in slag aggregate pavements was found to be seven times more frequent than in pavements containing other aggregates. No differences were found in riding quality and service life, but slag aggregate pavements exhibited a higher level of skid resistance. GRA

N76-31597# California Univ., Berkeley. Earthquake Engineering Research Center.

HYSTERETIC BEHAVIOR OF STEEL COLUMNS

Egor P. Popov, Vitelmo V. Bertero, and S. Chandramouli Sep. 1975 231 p refs Sponsored in part by the American Iron and Steel Inst., Washington, D. C.

(Grant NSF AEN-73-07732)

(PB-252365/2; EERC-75-11) Avail: NTIS HC $8.00 CSCL 13C

Strong inelastic (hysteretic) action in the columns of steel beam columns subassemblages is reported. A total of six specimens were tested. In four of these, the columns were bent around their strong axes; in two around their weak axes. The behavior of column plastic hinges subjected to random pseudo static cyclic loading was determined. Some tentative conclusions are presented. Author (GRA)

N76-31598# National Bureau of Standards, Washington, D.C. Center for Building Technology.

EQUIVALENT STATIC WIND LOADS FOR TALL BUILDING DESIGN Final Report

Emil Simiu 19 Jun. 1975 21 p refs Submitted for publication

(PB-252395/9) Avail: NTIS HC $3.50 CSCL 13M

A procedure for calculating alongwind response, including deflections and accelerations, which incorporates these advances is presented. The meteorological and aerodynamic models on which the procedure is based are described in brief. The practical use of the procedure is illustrated in a numerical example. Estimates are provided of errors inherent in the models employed. The range of applicability of the procedure is defined. Author (GRA)

N76-31599# California Dept. of Transportation, Sacramento. Transportation Lab.

FIELD APPLICATIONS OF POLYMER IMPREGNATION OF CONCRETE Final Report

D. L. Spellman, J. H. Woodstrom, S. N. Bailey, D. I. Nakao, and R. J. Spring Oct. 1975 53 p refs Sponsored by the Federal Highway Admin., Washington, D. C.

(PB-252327/2; CA-DOT-TL-5299-1-75-34; Rept-635299) Avail: NTIS HC $4.50 CSCL 13C

Oven dried concrete specimens were impregnated with a methyl methacrylate monomer system and polymerized by thermalcatalytic means. This treatment produced concrete having significant improvement in compressive strength, surface abrasion resistance, and reduction in permeability as measured by electrical resistance. A technique for the impregnation and polymerization of concrete with a monomer system was developed and successfully applied under field conditions to obtain 1/2 to 3/4 inch penetration. This application was made on a 10 foot x 90 foot section of a bridge deck. Author (GRA)

N76-31600# Princeton Univ., N.J. Dept. of Civil and Geological Engineering.

RECENT METHODS IN THE APPLICATION OF TEST RESULTS TO THE WIND DESIGN OF LONG, SUSPENDED-SPAN BRIDGES Final Report

R. H. Scanlan Oct. 1975 135 p refs

(PB-250482/7; RR-75-SM-9; FHWA-RD-75-115) Avail: NTIS HC $6.00 CSCL 13B

The main aspects of a body of theory for the interpretation of bridge section model wind tunnel tests and the subsequent dynamic analysis of the prototype bridge under wind, especially oriented to the elastically suspended, freely-oscillating deck model, is summarized. Chapter 1 presents an overview of the problems of long-span bridges under wind. Chapter 2 deals with bridge deck aerodynamic problems under steady flows. Chapter 3 extends the ideas to problems in the turbulent natural wind. GRA

N76-31601# Watervliet Arsenal, N.Y.

STABILITY ANALYSIS OF FREE-FREE BEAMS USING FINITE ELEMENTS: AN UNCONSTRAINED ADJOINT VARIATIONAL APPROACH

Julian J. Wu Nov. 1975 37 p refs

(DA Proj. 1F1-61102-A-35D)

(AD-A020424; WVT-TR-75061) Avail: NTIS CSCL 16/4

The stability behavior of a flexible missile idealized as a free-free beam is studied using the finite element technique. The structure is assumed to be under a constant thrust which, in turn, is subjected to a directional control device. A concentrated mass is included to model a piece of heavy machinery. The solution formulation - finite element in conjunction with unconstrained variational principles - is shown here to be general, simple to use and effective to overcome the difficulties arising from nonconservative forces, concentrated mass and feedback control features. As a basis of this approach, an unconstrained variational statement and the associated adjoint problems are introduced. GRA

N76-31602# Watervliet Arsenal, N.Y.

ON THE STABILITY OF A FREE-FREE BEAM UNDER AXIAL THRUST SUBJECTED TO DIRECTIONAL CONTROL

Julian J. Wu Dec. 1975 28 p refs

(AD-A020421; WVT-TR-75062) Avail: NTIS CSCL 16/4

This paper attempts to elucidate the mechanism of the loss of stability of a free-free beam subjected to a direction-controlled thrust. An adequate description of this basic problem does not appear to be available in the current literature. In contradiction to the claims made by several well-known investigations, it is shown here that (1) for a uniform beam under a constant thrust, the first nonzero eigenvalue represents an unstable bending mode, and (2) under directional control, the critical thrust varies with the sign and the magnitude of the control angle. Numerical data that have helped in understanding the problem are included. GRA

N76-31603# National Bureau of Standards, Washington, D.C. Metallurgy Div.
MECHANICAL FAILURE: DEFINITION OF THE PROBLEM. PROCEEDINGS OF THE 20TH MEETING OF THE MECHANICAL FAILURES GROUP Final Report
T. R. Shrives and W. A. Willard Apr. 1976 229 p refs Held at Washington, D.C., 8-10 May 1974
(PB-252185/4; NBS-SP-423; LC-76-600003) Avail: NTIS HC $8.00 CSCL 13I

The symposium was designed to explore with a broad brush the various aspects of mechanical failures. The definition of the problem of mechanical failures involved three aspects: (1) the modes of failure; (2) the consequences of failure; and (3) the implications (for action) of the occurrence of failures. The section on the modes of failure was constructed on the basis that all failures of machine and structural components are eventually traced to material failure. Following this basis, the investigation of large numbers of mechanical failures shows that the primary modes of failure are fatigue, stress corrosion, and brittle fracture. GRA

N76-31604# Texas Transportation Inst., College Station.
PREDICTION OF THERMAL REFLECTION CRACKING IN WEST TEXAS Research Report, Sep. 1972 - Mar. 1976
Hang-Sun Chang, Robert L. Lytton, and Samuel H. Carpenter Mar. 1976 106 p refs Sponsored by the Tex. State Dept. of Highways and Public Transportation
(PB-252084/9; TTI-2-8-73-18-3; RR-18-3; FHWA-RD-76-S0464) Avail: NTIS HC $5.50 CSCL 13B

A rational approach for the prediction of overlay life is presented and recommendations which are expected to extend the life of overlays are given. The predictions are made using linear elastic and viscoelastic stress analysis and viscoelastic fracture mechanics. These stresses are then applied to the crack surface to study the effects of material properties on crack development. The stress intensity factors necessary are calculated using the finite element technique with the crack tip elements developed by Plan. Predictions of service life are made using the empirical relationship developed by Paris. Author (GRA)

N76-31605# California Univ., Berkeley. Earthquake Engineering Research Center.
EARTHQUAKE SIMULATOR STUDY OF A STEEL FRAME STRUCTURE. VOLUME 2: ANALYTICAL RESULTS
David T Tang Oct. 1975 218 p refs
(Grant NSF GI-36387)
(PB-252926/1; EERC-75-36-Vol-2) Avail: NTIS HC $7.75 CSCL 13M

The development of mathematical models and the verification of response predictions for a three story single bay moment resistant frame structure is reported, using experimental results observed for the structure tested on a 20 ft x 20 ft shaking table. The overall background and the test design for the research program which consisted of two series of experiments are described. In the first series the panel zones of the structure were overdesigned. In the phase 2 study, the panel zones were reinforced to make the girders and columns the weak elements of the structure. GRA

N76-31606# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
WIND AND SEISMIC EFFECTS: PROCEEDINGS OF THE 6TH JOINT PANEL CONFERENCE OF THE US-JAPAN COOPERATIVE PROGRAM IN NATURAL RESOURCES Final Report
H. S. Lew Apr. 1976 465 p refs Conf. held in Gaithersburg, Md. 15-17 May 1974
(PB-252683/8; NBS-SP-444; LC-76-608055) Avail: NTIS HC $12.00 CSCL 13M

The subject matter covered in the conference papers includes extreme winds in structural design; assessment and experimental techniques for measuring wind loads; dynamics of soil structures and ground response in earthquakes; structural response to wind and earthquakes and design criteria; disaster mitigation against natural hazards; and technological assistance to developing countries. GRA

N76-31607# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
THE STEADY-STATE RESPONSE OF MULTIDEGREE-OF-FREEDOM SYSTEMS WITH A SPATIALLY LOCALIZED NONLINEARITY Ph.D. Thesis
Richard Keith Miller 1 Oct. 1975 204 p refs
(Grant NSF ATA-74-19135)
(PB-252459/3; EERL-75-03) Avail: NTIS HC $7.75 CSCL 13M

Considered is the dynamic response of a general linear system with a one dimensional nonlinear constraint attached between two points. The constraint may consist of conservative, hysteretic, and viscous elements. The method of equivalent linearization is used to develop approximate steady state equations for the response to arbitrarily distributed loads with harmonic time dependence. The qualitative response behavior of a class of undamped chainlike structures with a nonlinear terminal constraint is investigated. Presented are several theorems concerning the location and shape of resonance curves, the boundedness of forced response and the loci of response extrema. GRA

N76-31608# California State Dept. of Transportation, Sacramento. Div. of Structures.
FACTORS AFFECTING THE DURABILITY OF CONCRETE BRIDGE DECKS; CONSTRUCTION PRACTICES Interim Report
M. W. Horn, C. F. Stewart, and R. L. Boulware Mar. 1975 144 p refs
(PB-252423/9; CA-DOT-ST-4101-4-75-3; IR-4) Avail: NTIS HC $6.00 CSCL 13B

The concrete placement for twenty eight bridge decks was closely monitored and several crack surveys were made on them. Placement variables included 4 types of finishing machines, 2 types of hand finishing equipment, different timing of final finishing operations, different slumps, different timing of cure application and 3 methods of curing. The most consistent cause of large deck cracks (greater than 0.005 inches in width) are improper repair of concrete disturbed after strike off and hot, windy weather. Small cracking could not be eliminated but could be controlled to some degree by the finishing and curing methods.
Author (GRA)

N76-31183 European Space Agency, Paris (France).
AN ITERATIVE, SELF-ORGANISING METHOD FOR THE DETERMINATION OF STRUCTURAL DYNAMIC CHARACTERISTICS
Maurice Feix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-1 (ESA-TT-232) Dec. 1975 p 36-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-1, Jan.-Feb. 1975 p 21-33 (For availability see N76-31180 22-01)

N76-31192 European Space Agency, Paris (France).
ON THE USE OF BRANCH MODES FOR THE CALCULATION OF HELICOPTER STRUCTURAL DYNAMIC CHARACTERISTICS
Cam Thuy Tran, William Twomey, and Rolland Dat *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1973-6 (ESA-TT-308) Jul. 1976 p 51-80 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1973-6, Nov.-Dec. 1973 p 337-354 Sponsored by Soc. Natl. Ind. Aerospatiale (For availability see N76-31187 22-01)

N76-32101 European Space Agency, Paris (France).
THE VIBRATION TEST OF AN IMPERFECTLY LINEAR STRUCTURE
Rolland Dat *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 47-54 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 223-227 (For availability see N76-32097 22-99)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N76-31609*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
WATER UTILISATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Quarterly Progress Report
K. R. McCloy, Principal Investigator, K. John Shepherd, and J. C. Killick 2 May 1976 11 p refs Sponsored by NASA ERTS
(E76-10427; NASA-CR-148303; QPR-2) Avail: NTIS HC $3.50 CSCL 08H
There are no author-identified significant results in this report.

N76-31610*# College for Civil Engineering, Bucharest (Romania). Lab. for Remote Sensing.
USE OF LANDSAT DATA FOR NATURAL RESOURCES INVESTIGATION IN THE LOWER BASIN OF DANUBE AND DANUBE DELTA Progress Report, Jan. - Mar. 1976
Nicolale Oprescu, Principal Investigator Apr. 1976 32 p refs Sponsored by NASA and Romanian Commission for Space Activities Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10452; NASA-CR-148561; DaDelta-1/1) Avail: NTIS HC $4.00 CSCL 08F
There are no author-identified significant results in this report.

N76-31611*# Yacimientos Petroliferos Fiscales Bolivianos, La Paz.
GENERAL STUDY OF THE REGION OF LAKE TITICACA, BOLIVIA, USING A SATELLITE MULTISPECTRAL SCANNING SYSTEM. PETROLOGIC STUDY OF METAMORPHIC ROCKS IN THE ZONGO VALLEY IN BOLIVIA. INSTALLATION PROJECT OF A BACTERIA IN THE LOS MONOS PLAINS. GEOLOGICAL STUDY OF THE ULLA ULLA CHARAZANI REGION [ESTUDIO GENERAL DE LA REGION DEL LAGO TITICACA, EVALUANDO EN FORMA PRELIMINAR UN SISTEMADE ANALYSIS INTERACTIVO DE IMAGENES MULTIESPECTRALES. ESTUDIO PETROLOGICO DE LAS ROCAS METAMORFICAS DE UN SECTOR DEL VALLE DE ZONGO. PROYECTO INSTALACION DE UNA BATERIA EN EL CAMPO LOS MONOS. ESTUDIO GEOLOGICO DE LA REGION ULLA ULLA-CHARAZANI]
Carlos E. Brockmann, Principal Investigator Apr. 1976 104 p refs In SPANISH; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10453; NASA-CR-148562) Avail: NTIS HC $5.50 CSCL 08B
There are no author-identified significant results in this report.

N76-31612*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN, GREENLAND AREA Quarterly Progress Report
Torgny E. Vinje, Principal Investigator Aug. 1976 2 p Sponsored by NASA and Royal Norwegian Council for Sci. and Industrial Res. ERTS
(E76-10464; NASA-CR-148696; QPR-4) Avail: NTIS HC $3.50 CSCL 08L
There are no author-identified significant results in this report.

N76-31613*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. 1: INVESTIGATION OF SOIL EROSION IN HOKKAIDO WHICH IS CAUSED BY THAWING OF SOIL WATER IN LATE SPRING Quarterly Progress Report, Apr. - Jun. 1976
Takakazu Maruyasu and Shigechika Hayashi, Principal Investigators (Natl. Agricultural Experiment Station, Hokkaido, Japan) 16 Aug. 1976 6 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10465; NASA-CR-148697) Avail: NTIS HC $3.50 CSCL 04B
There are no author-identified significant results in this report.

N76-31614*# Zurich Univ. (Switzerland). Dept. of Geography.
NATURAL RESOURCES INVENTORY AND LAND EVALUATION IN SWITZERLAND Quarterly Report
Harold Haefner, Principal Investigator 24 Jun. 1976 12 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10466; NASA-CR-148698; QR-4) Avail: NTIS HC $3.50 CSCL 08F
The author has identified the following significant results. Using MSS channels 5 and 7 and a supervised classification system with a PPD classification algorithm, it was possible to map the exact areal extent of the snow cover and of the transition zone with melting snow patches and snow free parts of various sizes over a large area under different aspects such as relief, exposure, shadows etc. A correlation of the data from ground control, areal underflights and earth resources satellites provided a very accurate interpretation of the melting procedure of snow in high mountains.

N76-31615*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF VARIATIONS IN THE PROMINENT OCEANIC CURRENT, KUROSHIO Quarterly Report
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 1 Aug. 1976 7 p Sponsored by NASA ERTS
(E76-10467; NASA-CR-148699) Avail: NTIS HC $3.50 CSCL 04B
The author has identified the following significant results. Rias shorelines are interpreted from the fine depiction of their complex features in the image of band 7. Sand beaches are discriminated from their linear nature, and the similarity of sand beaches among the all-band is very good.

N76-31616*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. APPLICATION OF LANDSAT-2 DATA TO ENVIRONMENTAL STUDIES IN COASTAL ZONE Quarterly Progress Report, Apr. - Jun. 1976
Takakazu Maruyasu and Hiroaki Ochiai, Principal Investigators (Toba Merchant Marine Coll., Toba City, Japan) 30 Jun. 1976 6 p ref Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10468; NASA-CR-148700) Avail: NTIS HC $3.50 CSCL 04B

There are no author-identified significant results in this report.

N76-31617*# Ecole Practique des Hautes Etudes, Paris (France).
THE FRENCH ATLANTIC LITTORAL Progress Report, Apr. - Jun. 1976
Fernand Verger, Principal Investigator, J. M. Monget, and R. Regrain Jul. 1976 16 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10469; NASA-CR-148701; PR-3) Avail: NTIS HC $3.50 CSCL 08C

There are no author-identified significant results in this report.

N76-31618*# Army Construction Engineering Research Lab., Champaign, Ill.
USE OF SKYLAB S190B IMAGERY
R. K. Jain, Principal Investigator Jul. 1975 16 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4643)
(E76-10471; NASA-CR-144419) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-31619*# Department of Industry, London (England).
THE USE OF ERTS/LANDSAT IMAGERY IN RELATION TO AIRBORNE REMOTE SENSING FOR TERRAIN ANALYSIS IN WESTERN QUEENSLAND, AUSTRALIA Quarterly Report
Monica M. Cole and Stewart Wen-Jones, Principal Investigators 21 Jul. 1976 7 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10472; NASA-CR-148726) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Series of linears were identified on the March imagery of Lady Annie-Mt. Gordon fault zone area. The series with a WSW-ENE orientation which is normal to the major structural units and also several linears with NNW-SSE orientation appears to be particularly important. Copper mineralization is known at several localities where these linears are intersected by faults. Automated outputs using supervised methods involving the selection of training sets selected by visual recognition of spectral signatures on the color composites obtained from combinations of MSS bands 4, 5 and 7 projected through appropriate filters, were generated.

N76-31620*# Bechtold Satellite Technology Corp., City of Industry, Calif.
AN EVALUATION OF SKYLAB (EREP) REMOTE SENSING TECHNIQUES APPLIED TO INVESTIGATION OF CRUSTAL STRUCTURE Semiannual Report, 1 Jul. - 31 Dec. 1974
Ira C. Bechtold, Principal Investigator 31 Dec. 1974 17 p EREP
(Contract NAS9-14235)
(E76-10473; NASA-CR-144383; BESTEC-101-SA-6/75) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. A study of Greenwater Valley indicates that the valley is bounded on the north and east by faults, on the south by a basement high, and on the west by the dip slope of the Black Mountains. Movement of ground water from the valley is thus restricted, indicating the valley is a potential water reservoir.

N76-31621*# Alaska Univ., College.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Quarterly Progress Report
William J. Stringer, Principal Investigator [1975] 39 p Sponsored by NASA ERTS
(E76-10474; NASA-CR-148739; QPR-3) Avail: NTIS HC $4.00 CSCL 08L

The author has identified the following significant results. On the basis of analysis of late winter 1973, 1974, and 1975 LANDSAT imagery of the Beaufort Sea coast of Alaska, the following conclusions regarding near-shore ice conditions were made: (1) by March, the seaward limit of contiguous ice is often beyond the 10 fathom contour. (2) During March, shearing can and does take place along a line roughly coincident with the 10 fathom contour. (3) Ice motions during these shearing events are not extremely great, generally on the order of 10 km. (4) Many large ice features have already been formed by late February. (5) Based on look-ahead at later LANDSAT imagery, it seems apparent that Beaufort Seas shore-fast ice was already formed by late February and may well be safe for exploratory activities from this data forward until the melt season.

N76-31622*# Delaware Univ., Newark. Coll. of Marine Studies.
REMOTE SENSING OF ESTUARINE FRONTS AND THEIR EFFECTS ON POLLUTANTS
V. Klemas, Principal Investigator and D. F. Polis [1975] 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contracts NAS5-21937; NAS5-20983; Grant NSF GI-41896)
(E76-10475; NASA-CR-148782) Avail: NTIS HC $4.50 CSCL 08H

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 proved valuable in determining the location, type, and extent of estuarine fronts under different tidal conditions. Neither ships nor aircraft alone could provide as complete, synoptic, and repetitive an overview as did the satellites. Since estuarine fronts influence the movement of oil slicks and dispersion of other pollutants, cleanup operations depending on real time use of oil slick movement prediction models will benefit not only from aircraft tracking the actual slicks but also from real time satellite observations of surface currents and the location of frontal systems.

N76-31623*# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Aeronautical Charting and Cartography.
ERTS IMAGERY AS DATA SOURCE FOR UPDATING AERONAUTICAL CHARTS Final Report
Joe F. Wilson, Principal Investigator Jul. 1976 27 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG)
(E76-10476; NASA-CR-148783) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-31624*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
WATER QUALITY MAP OF SAGINAW BAY FROM COMPUTER PROCESSING OF LANDSAT-2 DATA
R. H. Rogers, Principal Investigator and J. B. McKeon Aug. 1976 7 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20942)
(E76-10477; NASA-CR-148784; BSR-4241) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-31625*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report
Paul E. Baldridge, Principal Investigator 10 Jun. 1976 5 p ERTS
(Contract NAS5-22399)
(E76-10478; NASA-CR-148785; QPR-4) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-31626*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Apr. - Jun. 1976
R. A. Halliday, Principal Investigator and I. A. Reid Jul. 1976 10 p Sponsored by NASA ERTS
(E76-10479; NASA-CR-148786) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-31627*# Norwegian Water Resources and Electricity Board, Oslo.
HYDROLOGICAL INVESTIGATIONS IN NORWAY Quarterly Report, 1 Nov. 1975 - 1 May 1976
Helge A. Odegaard, Principal Investigator 1 May 1976 6 p Sponsored by NASA ERTS
(E76-10480; NASA-CR-148787) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-31628*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
AREA SAMPLING FRAME CONSTRUCTION FOR AN AGRICULTURE INFORMATION SYSTEM WITH LANDSAT-2 DATA Progress Report, 17 Jul. 1975 - 16 Jul. 1976
William H. Wigton, Principal Investigator Sep. 1976 10 p Sponsored by NASA ERTS
(E76-10482; NASA-CR-148789) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-31629*# Kansas Univ., Lawrence. Space Technology Center.
A COMPREHENSIVE DATA PROCESSING PLAN FOR CROP CALENDAR MSS SIGNATURE DEVELOPMENT FROM SATELLITE IMAGERY Progress Report
R. M. Haralick, Principal Investigator, G. Minden, and A. Singh 1 Jul. 1976 59 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20943)
(E76-10483; NASA-CR-148790; TR-286-3; PR-3) Avail: NTIS HC $4.50 CSCL 05B

There are no author-identified significant results in this report.

N76-31630*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Jun. - Aug. 1976
W. J. VanderOord, Principal Investigator Sep. 1976 7 p Sponsored by NASA ERTS
(E76-10484; NASA-CR-148791; QR-4) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-31631*# Geological Survey, Miami, Fla.
AN ANALYSIS AND COMPARISON OF LANDSAT-1, SKYLAB (S-192) AND AIRCRAFT DATA FOR DELINEATION OF LAND-WATER COVER TYPES OF THE GREEN SWAMP, FLORIDA Final Report
A. L. Higer, Principal Investigator, A. E. Coker, N. F. Schmidt, and I. E. Reed Nov. 1975 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order CC-30280-A)
(E76-10485; NASA-CR-144855; BSR-4198) Avail: NTIS HC $4.00 CSCL 05B

The author has identified the following significant results. LANDSAT 1 and Skylab (S192) data from the Green Swamp area of central Florida were categorized into five classes: water, cypress, other wetlands, pine, and pasture. These categories were compared with similar categories on a detailed vegetative map made using low altitude aerial photography. Agreement of LANDSAT and Skylab categorized data with the vegetation map was 87 percent and 83 percent respectively. The Green Swamp vegetative categories may be widespread but often consist of numerous small isolated areas, because LANDSAT has a greater resolution than Skylab, it is more favorable for mapping the small vegetative categories.

N76-31632*# National Oceanic and Atmospheric Administration, Washington, D.C.
EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report
Donald R. Wiesnet, David F. McGinnis, Jr., Principal Investigators, Michael C. McMillan, and Michael Matson 15 Sep. 1976 3 p ERTS
(Contract NAS3-5991)
(E76-10487; NASA-CR-148793) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-31633*# Norsk Polarinstitutt, Oslo.
GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA Quarterly Progress Report
Olav Orheim, Principal Investigator 27 Aug. 1976 2 p Sponsored by NASA ERTS
(E76-10489; NASA-CR-148795; QPR-4) Avail: NTIS HC $3.50 CSCL 06C

There are no author-identified significant results in this report.

N76-31634*# Maden Tetkik ve Arma Enstitusu, Ankara (Turkey).
NATIONAL PROJECT FOR THE EVALUATION OF ERTS IMAGERY APPLICATIONS TO VARIOUS EARTH RESOURCES PROBLEMS IN TURKEY Progress Report, 1 Apr. - 1 Jul. 1976
Sadrettin Alpan, Principal Investigator 1 Jul. 1976 10 p Sponsored by NASA ERTS
(E76-10490; NASA-CR-148796; PR-3) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-31635*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 3: REVIEW OF LAND USE SURVEYS USING ORBITAL IMAGERY IN THE USA
J. L. VanGenderen, Principal Investigator and B. F. Lock Mar. 1976 26 p refs Sponsored by NASA EREP
(E76-10491; NASA-CR-148797) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Techniques of preprocessing, interpretation, classification, and ground truth sampling were studied. It has shown the need for a low cost, low level technology, viable, operational methodology to replace the emphasis given in the U.S. to machine processing, which many developing countries cannot afford, understand, nor implement.

N76-31636*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 4: REVIEW OF LAND USE SURVEYS USING ORBITAL IMAGERY OUTSIDE OF THE USA
J. L. VanGenderen, Principal Investigator and B. F. Lock Apr. 1976 18 p refs Sponsored by NASA EREP
(E76-10492; NASA-CR-148798) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Outside the U.S., various attempts were made to investigate the feasibility of utilizing orbital MSS imagery in the production of small scale land use maps. Overall, these studies are not as elaborate or extensive in their scope as the U.S. ones, and

generally the non-U.S. investigators have employed nonsophisticated and less expensive techniques. A representative range of studies is presented to demonstrate the approaches and trends dealing with reprocessing, interpretation, classification, sampling, and ground truth procedures.

N76-31637*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 5: EXPERIMENTAL AND OPERATIONAL TECHNIQUES OF MAPPING LAND USE
J. L. VanGenderen, Principal Investigator and B. F. Lock 1976 58 p refs Sponsored by NASA EREP
(E76-10493; NASA-CR-148799) Avail: NTIS HC $.50 CSCL 08B

The author has identified the following significant results. Scope of the preprocessing techniques was restricted to standard material from the EROS Data Center accompanied by some enlarging procedures and the use of the diazo process. Investigation has shown that the most appropriate sampling strategy for this study is the stratified random technique. A viable sampling procedure, together with a method for determining minimum number of sample points in order to test results of any interpretation are presented.

N76-31638*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 6: A LOW-COST METHOD FOR LAND USE MAPPING USING SIMPLE VISUAL TECHNIQUES OF INTERPRETATION
J. L. VanGenderen, Principal Investigator and B. F. Lock Jun. 1976 32 p refs Sponsored by NASA EREP
(E76-10494; NASA-CR-148800) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. It was found that color composite transparencies and monocular magnification provided the best base for land use interpretation. New methods for determining optimum sample sizes and analyzing interpretation accuracy levels were developed. All stages of the methodology were assessed, in the operational sense, during the production of a 1:250,000 rural land use map of Murcia Province, Southeast Spain.

N76-31639*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 7: BIBLIOGRAPHY
J. L. VanGenderen, Principal Investigator and B. F. Lock Aug. 1976 41 p refs Sponsored by NASA EREP
(E76-10495; NASA-CR-148801) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-31640*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE DATA FOR SURFACE-MINE INVENTORY
A. T. Anderson, D. Schultz (GE Co., Beltsville, Md.), N. Buchman (GE Co., Beltsville, Md.), and M. Nock (Maryland Geological Survey) Sep. 1976 19 p refs Submitted for publication
(NASA-TM-X-71187; X-923-76-199) Avail: NTIS HC $3.50 CSCL 08I

To determine the feasibility of satellite data for surface-mine inventory, particularly as it applies to coal, a case study was conducted in Maryland. A band-ratio method was developed to measure disturbed surface areas, and it proved to be extendible both temporally and geographically. This method was used to measure area changes in the region over three time periods from September 1972 through July 1974 and to map the entire two-county area for 1973. For mines ranging between 31 and 244 acres (12 to 98 hectares) the measurement accuracy of total affected acreage was determined to be 92%. Mines of 120 acres (50 hectares) and larger were measured with greater accuracy, some within one percent of the actual area. The ability to identify, classify, and measure strip-mine surfaces in a two-county area (1,541 square kilometers - 595 square miles) of western Maryland was demonstrated through the use of computer processing. On the basis of these results the use of LANDSAT satellite data and multilevel sampling of aircraft and field verification inspections, multispectral analysis of digital data is shown to be an effective, rapid, and accurate means of monitoring the surface mining cycle. Author

N76-31641*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CANOPY-RELATED STRATIFICATION OF A SOUTHERN PINE FOREST USING LANDSAT DIGITAL DATA
Darrel L. Williams Aug. 1976 16 p refs Presented at Proc., Am. Congr. on Surveying and Mapping, and Am. Soc. of Photogrammetry, Seattle, 28 Sep. - 1 Oct. 1976
(NASA-TM-X-71184; X-923-76-188) Avail: NTIS HC $3.50 CSCL 02F

An investigation was undertaken to determine if a consistent stratification of a Southern pine forest could be obtained by using LANDSAT multispectral scanner data to assess crown closure. Winter and summer LANDSAT scenes of the North Carolina coastal region were analyzed individually and then registered and merged to take advantage of temporal changes in the forest canopy. Three levels of pine crown closure were accurately delineated. The applicability of this stratification as supplemental input to a forest inventory system is also discussed. Author

N76-31642*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-31 MAY 1976
31 May 1976 125 p
(NASA-TM-X-74211; NTISUB/LU-76/005; GSFC/LU-76/005) Avail: NTIS HC $5.50 CSCL 05B

The U.S. standard catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm and frame on which the scene may be found is also given. Author

N76-31643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1-31 MAY 1976
31 May 1976 165 p
(NASA-TM-X-74210; NTISUB/B/139-76/005; GSFC/LN-76/005) Avail: NTIS HC $6.75 CSCL 05B

The non-U.S. standard catalog lists non-U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-31644*# Texas A&M Univ., College Station. Remote Sensing Center.
REMOTE SENSING ANALYSIS OF LAKE LIVINGSTON AQUATIC PLANTS Final Report
Arthur R. Benton, Jr. and Robert M. Newman Mar. 1976 41 p Sponsored in part by Trinity River Authority
(Grant NGL-44-001-001)
(NASA-CR-147975) Avail: NTIS HC $4.00 CSCL 06C

Results obtained during 1975 to monitor the growth of aquatic plants in the Lake Livingston area, using remote sensing photographic imagery, were described. Sequential total coverage was provided of the Jungle and White Rock Creek, plus coverage of smaller areas of localized infestation downlake, including Brushy Creek, KOA Kampground Marina, Penwaugh Slough, Memorial Point Marina, the Beacon Bay marinas and Pine Island. The imagery was generally good, photographic exposure being increased as the season progressed in order to obtain better pictures of the submerged vegetation. Some very significant differences in growth patterns, species interaction, and species dominance were observed when compared to 1974. Observation of the following plants was discussed: water hyacinth, hydrilla, coontail, potamageton. In general, the level of infestation was lower in 1975 than in 1974, due to the combined effect of more systematic application of herbicides and harsher intervening winter weather conditions. Y.J.A.

N76-31645# Physics Lab. RVO-TNO, The Hague (Netherlands).
INFRARED SEA BACKGROUND RADIATION
C. E. vanHaersmaBuma Aug. 1975 111 p refs
(PhL-1975-33; TDCK-66798) Avail: NTIS HC $5.50

A computer model is described for the infrared radiation received by a detector aimed at the sea surface, taking into account emitted and reflected components of this radiation, atmospheric transmission and emission. Parameters involved are temperature of sea and air, sea state, relative humidity and visibility, wind direction, position of the sun and clouds. The model is designed in order to study theoretically the influence of the respective parameters upon the radiation received.
Author (ESA)

N76-31646# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE PROCESSING OF RETROREFLECTION SPECTRA
W. J. P. A. Verbeek Oct. 1975 84 p refs
(PhL-1975-39; TDCK-66971) Avail: NTIS HC $5.00

An aspect of automatic aerial reconnaissance is described which deals with recognition of materials or objects by their reflection of light in a number of wavelength bands. In a study to select these bands various spectra are measured from 420 to 1152 nm (blue through infrared). The actual measurement is performed with a retroreflection meter. The transformation from the raw measurement data to reflectance spectra is done with a digital computer. The physical aspects of the measurement and the consequent derivation and construction of processing algorithms are presented in detail. The necessities for practical use of the programs are summed up in a way to accommodate a user who is not conversant with computer programming.
Author (ESA)

N76-31647# Cincinnati Univ., Ohio.
SEASONAL SOIL CREEP Final Report, 1 May 1974 - 30 Jun. 1975
Robert W. Fleming 15 Jan. 1976 67 p refs
(Contract DAHC04-74-G-0156)
(AD-A022562; ARO-11288.1-GS) Avail: NTIS CSCL 08/13

The report for the first year is an investigation of seasonal creep of soil. Flexible pipes, which change position in response to creeping soil, have been installed in three areas on the San Francisco Peninsula and two areas near Cincinnati, Ohio. Measurement of creep is obtained from successive readings of tilt of the pipes as a function of depth. Creep is being measured independently on square steel rods which were driven into the ground to different depths. Tilt of the rods is measured at the ground surface with a modified alidade. GRA

N76-31648# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
CHARACTERISTICS OF TENSIOMETRIC METHOD AND ITS SUITABILITY FOR DETERMINING HUMIDITY OF LIGHT SOIL
Jan Pabin Mar. 1976 22 p refs Transl. into ENGLISH from Instytyt Uprawy, Nawozenia i Gleboznawstwa (Warsaw), no. 51, 1972 p 145-161
(AD-A022487; CRREL-TL-516) Avail: NTIS CSCL 08/13

The investigations on the influence of various environmental factors on the readings of tensiometers of 'Biebrza' type have been carried out in the Department of Soil and Plant Cultivation IUNG at Laskowicz Olawskie. These instruments, due to the influence of the temperature and thermic gradient (under the field conditions) revealed slight diurnal fluctuations of the soil moisture tension but it did not cause an essential error in the measurements of moisture. GRA

N76-31649# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
MEASUREMENT OF THE VAPOR PRESSURE OF SOIL MOISTURE WITH MERCURY MANOMETER TENSIOMETERS AT AIR TEMPERATURES BELOW 0 C
O. Strebel Mar. 1976 10 p refs Transl. into ENGLISH from Z. Pflanzenernaehr. Dueng. Bodenk. (Weinheim), v. 126, no. 2, 1970 p 111-116
(AD-A022767; CRREL-TL-515) Avail: NTIS CSCL 08/13

A method for tensiometer measurements of soil moisture tension at air temperatures below 0 C is described. A column of decahydronaphthalin (-decalin, density 0.89) forms the hydraulic connection between the water in the tensiometer ceramic cell and the Hg-manometer. Experimental results and some restrictions of the method (especially the necessary solar radiation protection) are discussed. GRA

N76-31650# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AUTOMATIC FIELD RECORDING OF VAPOR PRESSURE OF SOIL MOISTURE WITH THE PRESSURE TRANSDUCER
O. Strebel, W. Giesel, M. Renger, and S. Lorch May 1976 13 p refs Transl. into ENGLISH froom Z. Pflanzenernaehr. Dueng. Bodenk. (West Germany), v. 126, no. 1, 1970 p 6-14
(AD-A022766; CRREL-TL-514) Avail: NTIS CSCL 08/13

From testing a pressure transducer-tensiometer for automatic recording of soil-moisture suction in the field the following conclusions were drawn: (1) The resolution is plus or minus 1 cm WS, due to high zero stability and low thermal shift; the response time is very short; (2) Above the soil surface there are no thermal sensitive instrument parts which influence the measuring result; the sensitivity to radiation and to air temperature below 0 C therefore is abolished. Furthermore measurements also in greater depths are easily possible; (3) Pressure transducer-tensiometers are particularly suitable to automatic recording of soil-moisture suction in the field, likewise to control of other systems such as irrigation systems. Two examples of soil-moisture suction measurements in a fine to medium sand are given. GRA

N76-31651# Office of Saline Water, Washington, D.C.
DESALTiNG PLANTS INVENTORY REPORT NO. 4
Frank OShaughnessy Apr. 1973 32 p
(PB-251575/7; W76-06152) Avail: NTIS HC $4.00 CSCL 07A

Summary information is provided on location, size, type of process, year construction began or of plant commissioning, and name of process contractor. Also included, are data on type of water feed, product water use, type of fuel used, and whether or not a desalting plant operates in conjunction with an electric power generating plant. According to manufacturers' information, there were 812 land-based desalting plants of 25,000 gallons per day capacity or larger in operation or under construction throughout the world as of January 1, 1972. Distillation is the most widely used, accounting for 93% of total capacity. The balance is almost entirely in membrane processes, with freezing accounting for less than 1%. GRA

N76-31652# Parsons (Ralph M.) Co., Los Angeles, Calif.
THE RALPH M. PARSONS COMPANY CONCEPTUAL DESIGN OF A 50 MGD DESALINATION PLANT Special Report No. 12
Aug. 1965 267 p
(Contract DI-14-01-0001-516)
(PB-251584/9; W76-06151) Avail: NTIS HC $9.00 CSCL 07A

A plant design is reported that advances the technology of sea water conversion based on a multistage flash process consisting of 94 heat recovery stages and 4 heat rejection stages with a maximum brine temperature of 273F. The plant consists of three parallel lines each supplying one third the total output, each operating independently of the others to facilitate maintenance and repairs. Vessels are of corrugated metal pipe arch section permitting longitudinal thermal expansion to be absorbed within the vessel walls. Interior surfaces of the vessels exposed to seawater are cupro-nickel clad. 70-30 CuNi is selected for heat exchange surfaces. Cost of product water is $0.525 per thousand gallons. GRA

N76-31653# Arizona Univ., Tucson. School of Renewable Natural Resources.
PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS M.S. Thesis
William Toby Hanes Jan. 1975 94 p refs
(Contract DI-14-31-0001-3858)
(PB-252858/6; W76-07764; OWRT-B-032-ARIZ(22)) Avail: NTIS HC $5.00 CSCL 08H

The accuracy of currently used long term runoff forecasting techniques, are limited because of their inability to deal with

the uncertainty in the amount of precipitation expected to fall after the forecast date. The basis for a simulation based, long term runoff forecasting technique is developed to overcome this problem by simulating future precipitation events. The technique utilizes a deterministic watershed snowmelt model and a sequence, event based stochastic precipitation model to provide daily precipitation data inputs for the watershed model. Author (GRA)

N76-31654# Utah Water Research Lab., Logan.
CAPABILITY OF INTEGER PROGRAMMING ALGORITHMS IN SOLVING WATER RESOURCE PLANNING PROBLEMS
Treavor C. Hughes, William J. Grenney, A. Bruce Bishop, Calvin G. Clyde, and Rangesan Narayanan Jan. 1976 105 p refs
(Contract DI-14-34-0001-6127)
(PB-250499/1; PRWG-175-1; W76-05183; OWRT-B-125-UTAH (1)) Avail: NTIS HC $5.50 CSCL 13B

The feasibility of optimizing large regional water resource planning problems by means of integer programming algorithms is analyzed. Two types of integer programming models are developed: (1) A water supply model including 23 separate but geographically related community systems; and (2) a river basin water quality model including 15 point sources of waste water, 4 types of pollutants, 6 surveillance points, and 7 alternative treatment processes. The water supply model was structured as a mixed integer problem (some continuous variables included) while the water quality model was an all integer problem. Four integer programming algorithms were tested on the sample problems as follows: (1) MXINT - The Burroughs B6700 TEMPO package algorithm; (2) FMPS-MIP-The UNIVAC 1108 MPS package algorithm; (3) GMINT - A proprietary algorithm authored by A.M. Geoffrion and R.D. McBride; and (4) AIP - A 0, 1 algorithm which uses the Balas additive concept. GRA

N76-31655# Environmental Protection Agency, Corvallis, Oreg.
DESIGN GUIDELINES FOR AGRICULTURAL SOIL WARMING SYSTEMS UTILIZING WASTE HEAT Interim Report
David L. Siegel Mar. 1976 38 p refs
(PB-252251/4; EPA-600/3-76-026) Avail: NTIS HC $4.00 CSCL 02C

A computer program that solves the equations governing heat and water transfer in soils was used to simulate the operation of a soil warming system composed of a series of buried pipes at uniform spacing and depth carrying warm water. The results included temperature and moisture content distributions for various soil warming system pipe spacings and depths and for varying weather conditions. Annual temperature cycles are presented for Portland, Oregon; Athens, Georgia; and St. Paul, Minnesota; for soil with no heating; and for soil with a continuously operating soil warming system. GRA

N76-31656# Environmental Protection Agency, Cincinnati, Ohio. Storm and Combined Sewer Section.
URBAN RUNOFF POLLUTION CONTROL PROGRAM OVERVIEW FY 1976
Richard Field, Anthony N. Tafuri, and Hugh E. Masters Mar. 1976 77 p
(PB-252223/3; EPA-600/2-76-095) Avail: NTIS HC $5.00 CSCL 13B

The report reviews EPA's Urban Runoff Pollution Control Research, Development, and Demonstration Program for the fiscal year of 1976 -- the basic pollution flood control and soil erosion problems created by urban runoff; governmental administration and incentive problems; EPA R&D organizational structure; nationwide cost requirements to abate urban runoff pollution; and available abatement technology along with ongoing and perceived developments. General cost comparisons for urban runoff pollution control/treatment are given along with a specific example of a cost-effect solution for urban runoff pollution control by in-line storage in Seattle, Washington, and a simplified hypothetical plan for wet-weather flow pollution abatement for the Des Moines, Iowa area. GRA

N76-31657# Goodyear Aerospace Corp., Akron, Ohio.
ASSOCIATIVE ARRAY PROCESSING OF RASTER SCANNED DATA FOR AUTOMATED CARTOGRAPHY Final Technical Report, Jan. 1975 - Mar. 1976
R. G. Radosevic, N. J. Adams, J. M. Vocar, and K. Losch Mar. 1976 347 p refs
(Contract DAAK02-75-C-0114)
(AD-A022753; GER-16327; ETL-0046) Avail: NTIS CSCL 08/2

The primary objective for this effort was to develop additional STARAN AAP-raster processing software that would be used to process a variety of actual map data. This would then provide a means to further evaluate the suitability of a STARAN AAP for the processing of raster scanned data. GRA

N76-31658# Bureau of Mines, Anchorage, Alaska. Field Operation Center.
GEOTHERMAL ENERGY: ECONOMIC POTENTIAL OF THREE SITES IN ALASKA Information Circular, 1975
Jimmie C. Rosenbruch and Robert G. Bottge Dec. 1975 47 p refs
(PB-249878/0; BM-IC-8692) Avail: NTIS HC $4.00 CSCL 08I

The prospects for using geothermal energy to generate electricity for mines in remote areas of Alaska are evaluated. Given the development of a geothermal resource for one purpose, the subsidiary uses of space heating and agriculture are examined to see if other industries might be viable given a cheap source of heat energy. Sites investigated are located in three areas of the state: Kobuk in the northwest, Unalaska in the southwest, and Stikine River in the southeast. Each site is relatively close to mineral deposits whose prospects for development would be enhanced with cheap power. GRA

N76-31659# Pennsylvania State Univ., University Park.
ECONOMIC ANALYSIS OF COAL SUPPLY: AN ASSESSMENT OF EXISTING STUDIES, VOLUME 1 Final Report
Richard L. Gordon Feb. 1976 152 p refs Sponsored by Electric Power Res. Inst.
(PB-249619/8; EPRI-335-1-Vol-1) Avail: NTIS HC $6.75 CSCL 08I

A partial listing of contents includes: Long run mineral supply--The case of coal in the United States; Systems studies of coal production; Environmental regulation and the allocation of coal; Regional analysis of the U.S. Electric Power Industry; Economic comparison of base load generation alternatives for New England Electric; Energy supply/demand alternatives for the Appalachian Region; An analysis of constraints on increased coal production; Analysis of steam coal sales and purchases; Energy alternatives; Economic and technological analysis of initiatives and innovations to secure fuel supply independence; processes, procedures, and methods to control pollution from mining activities. Author (GRA)

N76-31660# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
DEVELOPMENT OF SNOW WATER EQUIVALENT SURVEY METHODS USING AIRBORNE GAMMA MEASUREMENTS Progress Report, Jan. - Sep. 1975
A. E. Fritzsche and C. Juniper Nov. 1975 30 p refs
(Contract E(29-11)-1183)
(PB-250709/3; EGG-1183-1677; NOAA-76021103) Avail: NTIS HC $4.00 CSCL 08L

The progress made during the period March 1975 through September 1975 on EG and G's support of NOAA for development of airborne techniques for measurement of the water equivalent of snow and soil moisture is reported. The work included a series of snow and soil moisture surveys and development of a new detector and data acquisition system. The status is summarized together with a review of plans for the immediate future. In addition, suggestions for other future work are discussed and recommendations made. GRA

N76-31661# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
SOIL MOISTURE SURVEY EXPERIMENT AT LUVERNE, MINNESOTA. DATA OF SURVEY: 12 MAY 1975
E. L. Feimster and A. E. Fritzsche 12 May 1975 35 p refs
(Contract NOAA-31-USC-686)
(PB-250634/3; EGG-1183-1675; NOAA-76021105) Avail: NTIS HC $4.00 CSCL 08M

An aerial survey employing the measurement of natural terrestrial gamma radiation was carried out over farm lands south of Luverne, Minnesota on May 12, 1975. The purpose of the

survey was to determine soil moisture content. Soil moisture values were computed from airborne gamma data and compared to data collected during a similar survey of March 6, 1973. These soil moistures were compared to soil moistures computed gravimetrically. The results indicate very good agreement between the aerial and the ground measured soil moistures. The average soil moisture value for the 8-mi long survey lines derived from these aerial measurements were in good agreement with results from ground based soil sampling. Mile-by-mile averages of the aerial data ranged from 21 to 36% for Line A with an average of 27%. This compares well to the ground based soil moisture values ranging from 23 to 29% with an average of 28%. GRA

N76-31662# Arizona Univ., Tucson. School of Renewable Natural Resources.
DECISION ANALYSIS FOR WATERSHED MANAGEMENT ALTERNATIVES Completion Report
M. M. Fogel, J. L. Thames, L. Duckstein, and D. R. Davis Jan. 1976 20 p refs
(Contract DI-14-31-0001-3858)
(PB-252189/6; OWRT-B-032-ARIZ(23)) Avail: NTIS HC $3.50 CSCL 13B

A methodology for watershed managers to use in resource development and conservation decision making is reported. Stochastic event based precipitation models were derived to serve as inputs into deterministic watershed models with the result that a time series of hydrologic outputs could be obtained. These outputs, water and sediment yields and peak flow rates, could then be used to reflect the extent of man's activities in modifying the environment, as well as the optimal design and operation of water control facilities. GRA

N76-31663# Bureau of Mines, Dallas, Tex. Div. of Petroleum and Natural Gas.
DEPTH AND PRODUCING RATE CLASSIFICATION
W. D. Dietzman Mar. 1976 29 p refs
(PB-252492/4; BM-IC-8675A) Avail: NTIS HC $4.00 CSCL 08I

Statistics are presented pertaining to distribution of petroleum reservoirs (or fields), wells, and production by depth and producing rate classification in the United States. Data are presented in tabular form by state for the 18 principal oil-producing states and by subdivision for the two largest oil producing states, Texas and Louisiana. Also tabular summations and graphical illustrations are presented for the nation. GRA

N76-31664# Bureau of Mines, Washington, D.C. Div. of Economic Analysis.
THE STATE OF THE UNITED STATES COAL INDUSTRY--A FINANCIAL ANALYSIS OF SELECTED COAL PRODUCING COMPANIES WITH OBSERVATIONS ON INDUSTRY STRUCTURE Information Circular 1976
T. T. Tomimatsu and Robert E. Johnson Mar. 1976 40 p refs
(PB-252496/5; BM-IC-8707) Avail: NTIS HC $4.00 CSCL 08I

This report discusses the corporate structure dynamics, methods of financing, and financial assessment approaches that should be utilized to evaluate the economic health of the coal industry. It suggests rates of return and other measures of corporate economies necessary to attract capital required to finance emerging coal demand, plus impact of coal sales to total revenues. The study illuminates the activities of 30 selected coal-producing companies, including their subsidiaries or affiliates, that were responsible for approximately 60 percent of the total U.S. production in 1974. GRA

N76-31665# Illinois Univ., Urbana. Dept. of Civil Engineering.
RATIONAL DESIGN FOR CLOSE-RANGE PHOTOGRAMMETRY
G. T. Marzan and H. M. Karara Jan. 1976 236 p refs
(Grant NSF GK-11655)
(PB-252447/8; UILU-ENG-76-2001; Photogrammetry-Ser-43) Avail: NTIS HC $8.00 CSCL 08B

The optimization of closeranging photogrammetric systems, i.e. the selection of the most economical approach, instrumentation and methods to handle a particular task were studied, taking into account the accuracy requirements and the equipment available. A procedure for the selection of the optimum system and its components was developed and a computer program written for its implementation. A table giving the proper combination of convergence and overlap angles associated with an optimum design is given. Full documentation of the Direct Linear Transformation (DLT) program which was developed earlier at the University of Illinois is included. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-31666* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR CELL GRID PATTERNS Patent
Robert K. Yasui (JPL) and Paul A. Berman, inventors (to NASA) (JPL) Issued 29 Jun. 1976 8 p Filed 19 Apr. 1974 Supersedes N76-23709 (14 - 14, p 1819) Continuation-in-part of abandoned US Patent Appl. SN-296622, filed 11 Oct. 1972 Sponsored by NASA
(NASA-Case-NPO-13087-2; US-Patent-3,966,499; US-Patent-Appl-SN-462341; US-Patent-Class-136-206; US-Patent-Class-136-89; US-Patent-Appl-SN-296622) Avail: US Patent Office CSCL 10A

A grid pattern is described for a solar cell of the type which includes a semiconductive layer doped to a first polarity and a top counter-doped layer. The grid pattern comprises a plurality of concentric conductive grids of selected geometric shapes which are centered about the center of the exposed active surface of the counter-doped layer. Connected to the grids is one or more conductors which extend to the cell's periphery. For the pattern area, the grids and conductors are arranged in the pattern to minimize the maximum distance which any injected majority carriers have to travel to reach any of the grids or conductors. The pattern has a multiaxes symmetry with respect to the cell center to minimize the maximum temperature differentials between points on the cell surface and to provide a more uniform temperature distribution across the cell face.
Official Gazette of the U.S. Patent Office

N76-31667* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL ENERGY STORAGE SYSTEM Patent
Lott W. Brantley, Jr., inventor (to NASA) Issued 31 Aug. 1976 5 p Filed 7 Aug. 1975 Supersedes N75-29547 (13 - 20, p 2541)
(NASA-Case-MFS-23167-1; US-Patent-3,977,197; US-Patent-Appl-SN-602618; US-Patent-Class-60-659; US-Patent-Class-165-10) Avail: US Patent Office CSCL 10C

A thermal energy storage system is described for converting a fluid such as water into a superheated vapor for driving a turbine and it also includes an energy storage device for storing thermal energy from the vapor to be utilized should the pressure of the vapor fall below a predetermined value. The energy storage device includes a storage tank having a plurality of stacked vertical compartments containing metallic spheres filled with metal alloy for storing the thermal energy therein and a fluid reservoir below the stacked compartments. Diagrams of the system are shown. Official Gazette of the U.S. Patent Office

N76-31668 Catholic Univ. of America, Washington, D.C.
APPLICATION OF THE THERMODIELECTRIC EFFECT TO THE CONVERSION OF SOLAR TO ELECTRICAL ENERGY Ph.D. Thesis
Francisco Javier Garcia 1976 139 p
Avail: Univ. Microfilms Order No. 76-19369

A description of thermodielectric energy conversion and its limitations is presented, and the thermodielectric conversion cycle is classified as a coupled even-class converter. When the limitations of the cycle are taken into consideration the efficiency of the cycle is found to have a maximum at a given temperature difference. Theoretical expressions for the already known cycle and a new maximum field cycle are presented. Results indicate that ferroelectric materials produce efficiencies too low to be considered in a practical converter application. However, experimental tests show that a thermodielectric polymer, polyvinylidene fluoride, is well suited for this type of conversion. Efficiencies considerably higher than previously reported were measured. Better quality materials could produce even higher efficiencies, which, according to available data, would be in the order of at least 5%. Dissert. Abstr.

N76-31669# Committee on Commerce (U. S. Senate).
AUTOMOBILE FUEL ECONOMY AND RESEARCH AND DEVELOPMENT
Washington GPO 1975 529 p refs Hearings on S. 307, S. 499, S. 633, and amendment 15, S. 654, and S. 783, 94th Congr., 1st Sess., 12-13 Mar. 1975
(GPO-50-805) Avail: Comm. on Commerce

Hearings are presented before the Committee On Commerce, United States Senate. The hearings cover the topics: (1) full efficiency in automobiles, (2) Federal Government's role in conducting research on advanced automobiles, (3) automobile fuel economy and air pollution, (4) automobile safety standards, and (5) the President's voluntary program of a 40-percent improvement in fuel efficiency of the 1981 model year. These topics are discussed with a view toward energy conservation, consumer protection and pollution control. L.S.

N76-31670# General Electric Co., Philadelphia, Pa.
TEST REPORT FOR BSE CELLS AND BATTERIES
H. Thierfelder 1 Jun. 1976 111 p
(Doc-76SDS023) Avail: GE/Space and RESD Libraries, P. O. Box 8555, Philadelphia, Pa. 19101 HC $10.00/MF $10.00

A comprehensive test program was completed for the acceptance and qualification of nickel cadmium cells and batteries to be used on the broadcasting satellite experiment. One hundred and seventy two sealed nickel cadmium cells were fabricated into three protoflight and three flight batteries. Computer controlled testing, and data acquisition provided data tapes which were then used to plot the charge and discharge curves. Author

N76-31671*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A SOLAR COLLECTOR FIELD WATER FLOW NETWORK
John E. Rohde and Richard H. Knoll Washington Aug. 1976 29 p refs
(NASA-TM-X-3414; E-8709) Avail: NTIS HC $4.00 CSCL 10A

A number of methods are presented for minimizing the water flow variation in the solar collector field for the Solar Building Test Facility at the Langley Research Center. The solar collector field investigated consisted of collector panels connected in parallel between inlet and exit collector manifolds to form 12 rows. The rows were in turn connected in parallel between the main inlet and exit field manifolds to complete the field. The various solutions considered included various size manifolds, manifold area change, different locations for the inlets and exits to the manifolds, and orifices or flow control valves. Calculations showed that flow variations of less than 5 percent were obtainable both inside a row between solar collector panels and between various rows. Author

N76-31672# Committee on Interior and Insular Affairs (U. S. Senate).
THE 94TH CONGRESS AND THE ENERGY RECORD
Washington GPO 1976 78 p refs Rept. pursuant to S. Res. 45 for Comm. on Interior and Insular Affairs, 94th Congr., 2d Sess., 1976 Prepared by Library of Congr.
(GPO-67-716) Avail: Comm. on Interior and Insular Affairs

Congressional measures to encourage the conservation of energy and the development of new energy sources are reviewed. Petroleum and its products, coal, natural gas, nuclear energy and solar energy are included. D.M.L.

N76-31673# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
A NEW REGENERATOR MODEL FOR STIRLING CYCLE MACHINES
I. Urieli and C. J. Rallis May 1976 43 p refs
(ISBN-0-85494-389-7; Rept-67) Avail: NTIS HC $4.00

Disadvantages of the Schmidt cycle, against which the performance of 'practical' Stirling cycle machines has been compared, are discussed. A regenerator model is proposed in which the regenerator is subdivided into a finite number of thermodynamic cells. The n-cell regenerator model allows the incorporation of realistic effects contributing to imperfect regeneration, including finite regenerator matrix heat capacity, fluid friction, finite heat transfer and heat loss. This report is concerned with the validation of the model, and only the effect of a finite regenerator matrix heat capacity is analysed. The system is described by a set of total differential equations which can be solved as a standard initial value problem. Author

N76-31674*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INORGANIC-ORGANIC BATTERY SEPARATOR FOR ALKALINE BATTERIES Patent Application
Dean W. Sheibley, inventor (to NASA) Filed 7 Sep. 1976 11 p
(NASA-Case-LEW-12649-1; US-Patent-Appl-SN-720521) Avail: NTIS HC $3.50 CSCL 10C

A flexible separator for use between the electrodes of Ni-Cd and Ni-Zn batteries using alkaline electrolytes is considered. The separator is made by coating a porous substrate such as sheets or mats of asbestos or other materials with a battery separator composition. The coating material includes a rubber-based resin copolymer, a plasticizer and inorganic and organic fillers which comprise 55 percent by volume or less of the coating as finally dried. One or more of the filler materials, whether organic or inorganic, is preferably active with the alkaline electrolyte to produce pores in the separator coating. The plasticizer is an organic additive such as a material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the separator coating. NASA

N76-31675# Committee on Commerce (U. S. Senate).
NATURAL GAS PRODUCTION AND CONSERVATION ACT OF 1975
Washington GPO 1975 146 p refs Rept. on S. 692 for Comm. on Commerce, 94th Congr., 1st Sess., 12 Jun. 1975
(S-Rept-94-191) Avail: US Capitol, Senate Document Room

The major purpose of S. 692 is to regulate commerce to assure increased supplies of natural gas at reasonable prices for the consumer. Various issues concerning this bill are analyzed, including maximizing natural gas production, protection against inordinate price increases, and fair allocation of supplies. The text of the bill is included. D.M.L.

N76-31676# Committee on Interior and Insular Affairs (U. S. Senate).
ESTIMATES OF THE ECONOMIC COST OF PRODUCING CRUDE OIL
Washington GPO 1976 440 p refs Publication pursuant to S. Res. 45 for Comm. on Interior and Insular Affairs, 94th Congr., 2d Sess., 1976
(GPO-64-282) Avail: Comm. on Interior and Insular Affairs

Information concerning the cost of producing oil from existing reserves and of finding, developing, and producing oil from new sources of supply is presented. The cost of natural gas production is also considered. D.M.L.

N76-31677# Brookhaven National Lab., Upton, N.Y.
USER'S GUIDE FOR REGIONAL REFERENCE ENERGY SYSTEMS
H. Bronheim, R. Nathans, and P. F. Palmedo Nov. 1975 96 p refs Sponsored by ERDA and NSF Prepared in cooperation

with State Univ. of New York, Stony Brook
(BNL-20426) Avail: NTIS HC $5.45

A user's guide to an analytical approach to energy planning originally developed for national analysis, but now adaptable to regional and state planning is presented. A number of reports are available that summarize the development and use of the regional energy planning methodology. The structure of the model and how it is used and where data are available and how they can be assembled into the analytical framework are described. The various sections of the model--energy demands, electricity demand, fossil fuel supply--are described and the means to construct them are laid out in the user assembly forms. A submodel for estimating residential energy consumption and commercial heating and air conditioning load calculation are data supplied. The version of the methodology presented does not depend on the use of computers. A computerized version of the methodology is available and is convenient both from the point of view of data storage and manipulation and from the point of view of policy analysis. ERA

N76-31678# Brookhaven National Lab., Upton, N.Y.
PERSPECTIVE ON THE ENERGY FUTURE OF THE NORTHEAST: ENERGY CONSERVATION SCENARIOS FOR THE NORTHEAST UNITED STATES
M. Marmor Sep. 1975 41 p refs Sponsored by ERDA
(BNL-20783) Avail: NTIS HC $4.00

Measures were studied for energy conservation in the northeast United States for three scenarios: a base case, moderate, and severe conservation scenarios--corresponding to three levels of implementation of each of the conservation measures. The residential, commercial, and transportation sectors are reported. A largely technological view of energy conservation for purposes of assessing what is possible is presented. The next step is to examine the various policy options available to bring about technological changes that are found to be attractive in this analysis. The range of conservation measures that should be considered for application in the northeast is established by first summarizing the literature on energy conservation at the national level. From a survey of the measures considered in these studies, a set of measures for possible implementation in the Northeast is chosen. Author (ERA)

N76-31679# Argonne National Lab., Ill.
BATTERY RESEARCH SPONSORED BY THE US ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
A. A. Landgrebe and P. A. Nelson 1976 12 p refs Presented at Symp. on US Lithium Resources and Requirements by the Year 2000, Lakewood, Colo., 22 Jan. 1976
(Contract W-31-109-eng-38)
(CONF-760112-1) Avail: NTIS HC $3.50

A presentation on battery research is given. The development of lithium-aluminum/iron sulfide batteries for the purpose of load-leveling on electric utilities, automotive propulsion and application to new generating systems is discussed. Present programs on developing these batteries and the justification for the programs are described. L.S.

N76-31680# Energy Research and Development Administration, Washington, D.C. Div. of Reactor Research and Development.
LMFBR: ITS NEEDS AND TIMING: DISCUSSION OF THE NEED TO CONTINUE TIMELY LMFBR DEVELOPMENT, INCLUDING COMMENTS ON BYPASSING THE BREEDER BY NRDC
20 May 1975 140 p refs
(ERDA-38) Avail: NTIS HC $10.00

The electric power situation today and as predicted for the future is analyzed. An economic assessment of the LMFBR program is summarized. The comments of the Natural Resources Defense Council in Bypassing the Breeder are examined point by point. NSA

N76-31681# Brookhaven National Lab., Upton, N.Y.
SYSTEMS STUDIES OF DUAL PURPOSE ELECTRIC/SYNTHETIC FUELS FUSION PLANTS
E. Beardsworth and J. Powell Feb. 1975 53 p refs Presented at Am. Nucl. Soc. Meeting, New Orleans, 8 Jun. 1975 Sponsored by ERDA
(BNL-20731; Conf-750607-40) Avail: NTIS HC $4.50

A reactor power plant is proposed that can meet base load electrical demand, while the remainder can generate synthetic fuels and meet intermittent electrical demands. Two principal objectives of this study are: (1) to examine how strongly various economic demand and resource factors affect the amount of installed CTR capacity, and (2) to examine what increase in CTR capacity can be expected with dual purpose electric/synthetic fuel fusion plants, and also the relative importance of the different production modes. NSA

N76-31682# Argonne National Lab., Ill.
ASSESSMENT STUDY OF DEVICES FROM THE GENERATION OF ELECTRICITY FROM STORED HYDROGEN
J. P. Ackerman, J. J. Barghusen, and L. E. Link Dec. 1975 34 p refs
(Contract W-31-109-eng-38)
(ANL-75-71) Avail: NTIS HC $5.00

A study was performed to evaluate alternative methods for the generation of electricity from stored hydrogen. The generation systems considered were low temperature and high temperature fuel cells, gas turbines and steam turbines. These systems were evaluated in terms of present-day technology and future (1995) technology. Of primary interest were the costs and efficiencies of the devices, the versatility of the devices toward various types of gaseous feeds, and the likelihood of commercial development. On the basis of these evaluations, recommendations were made describing the areas of technology which should be developed. Author (NSA)

N76-31683# Oak Ridge National Lab., Tenn. Cryoelectrics Section.
CRYOGENIC POWER TRANSMISSION TECHNOLOGY: CRYOGENIC DIELECTRICS Quarterly Report, 1 April - 30 Jun. 1975
Feb. 1976 85 p ref
(Contract W-7405-eng-26)
(ORNL-TM-5210) Avail: NTIS HC $6.00

Alternating current dielectric breakdown and partial discharge measurements were carried out on several polyolefin films immersed in liquid helium at atmospheric pressure. The average breakdown strengths ranged from 135 to 220 MV/m. Analysis of the partial discharge inception voltages shows that the major determinant of partial discharge inception is the breakdown voltage of the helium layer in series with the film. In other experiments on Valeron polyethylene with both film and electrodes encapsulated by epoxy, breakdown occurred with no observable partial discharge. The Partial discharge sensitivity was the same as used for unencapsulated film experiments. The breakdown strength with encapsulation was slightly higher than without. Breakdown tests with ac voltage were carried out on liquid helium. The peak breakdown voltages measured on the first run were somewhat lower than previously measured dc voltages. After repolishing the electrodes, another run in which both dc and ac breakdown voltages were taken showed good agreement.
Author (NSA)

N76-31684# California Univ., Livermore. Lawrence Livermore Lab.
POSSIBILITIES FOR CONTROLLING HEAVY METAL SULFIDES IN SCALE FROM GEOTHERMAL BRINES
D. D. Jackson and J. H. Hill 19 Jan. 1976 17 p refs
(Contract W-7405-eng-48)
(UCRL-51977) Avail: NTIS HC $3.50

An outline is given of the types of reactions influencing sulfide precipitation in scale from geothermal brines. It is suggested that two factors affecting sulfide solubility and that are amenable to chemical modification of the brine are oxidation state and pH. A partial oxidation process can be used to convert aqueous sulfide species to free sulfur, a process favored by thermodynamics and kinetics. Some oxidizing agents are suggested for this purpose. A discussion is given of the possibilities of precipitating other solid phases after extensive oxidation. It is concluded on the basis of the available data that this possibility exists, but that uncertainties in reaction kinetics, unavailable data, and solution complexity make an exact analysis difficult. The usefulness of a field evaluation of chemical modification processes is indicated.
Author (GRA)

N76-31685# California Univ., Livermore. Lawrence Livermore Lab.
SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS
J. H. Hill and C. J. Morris 5 Dec. 1975 27 p refs Presented at the workshop on Sampling Effluents, Las Vegas, Nev., 20 Oct. 1975
(Contract W-7405-eng-48)
(UCRL-77544; Conf-750186-1) Avail: NTIS HC $4.00

An experiment designed primarily to define the problems associated with sampling the two-phase flow in a pipeline of geothermal brine is described. Analyses reported for 26 samples include chemical composition, oxidation potential, pH, density, and total solids. Changes in brine composition as the well operated during a four-week period are evaluated. The apparatus and techniques used for sampling are described and evaluated. ERA

N76-31686# California Univ., Livermore. Lawrence Livermore Lab.
LITHIUM REQUIREMENTS FOR ELECTRIC VEHICLES USING LITHIUM-WATER-AIR BATTERIES
J. F. Cooper, I. Y. Borg, L. G. OConnell, E. Behrin, B. Rubin, and H. Wiesner 12 Nov. 1975 18 p refs Presented at the Symp. on U.S. Lithium Resources and Requirements by the Year 2000, Lakewood, Colorado, 22-24 Jan. 1976
(Contract W-7405-eng-48)
(UCRL-77440; Conf-760112-2) Avail: NTIS HC $4.50

In the electrochemical reaction involved in the lithium-water-air battery lithium, oxygen, and CO2 are combined; Li2CO3 is left as a by product to be removed from the battery and recycled. A subcompact car weighing 910 kg would transform 7.2 kg of lithium in traveling 320 km at 97 km/hr. At least an equal amount of lithium per car would be unavailable because of the need to recycle the by-product (Li2CO3). Thus, a minimum of 14.4 kg of lithium per car is required to support a transportation system based upon this power source. Assuming that, in the year 2000, 12 to 16 percent of all vehicles are powered by lithium-water-air batteries, we will need 234,000 to 425,000 metric tons of lithium. This amount is somewhat less than the total known U.S. lithium reserves; but, if the current rate of consumption of lithium for other purposes continues, the supply of lithium will have to be increased. Author (ERA)

N76-31687# Aerojet Nuclear Co., Idaho Falls, Idaho.
ANALYSIS OF THE BINARY CYCLE FOR GEOTHERMAL POWER GENERATION
W. W. Madsen and I. J. Ingvarsson Dec. 1975 97 p refs
(Contract E(10-1)-1375)
(ANCR-1245) Avail: NTIS HC $6.00

Exchanging heat from hot geothermal fluid to a secondary working fluid which is then expanded through a turbine appears to be the best way of producing electrical power from a medium temperature geothermal resource. A study was made to determine the conceptual design state points for a dual boiling system which utilizes isobutane as the working fluid. The results of this work and the sensitivity of plant performance to variations from nominal design points are presented. In addition, variations due to tolerances applied to thermodynamic properties and other key factors are included. Author (ERA)

N76-31688# Aerojet Nuclear Co., Idaho Falls, Idaho.
CONCEPTUAL DESIGN AND COST EVALUATION OF ORGANIC RANKINE CYCLE ELECTRIC GENERATING PLANT POWERED BY MEDIUM TEMPERATURE GEOTHERMAL WATER
R. H. Dart (Idaho Natl. Eng. Lab.), D. T. Neill (Indaho Natl. Eng. Lab.), and J. F. Whitbeck (Idaho State Univ.) Dec. 1975 80 p refs
(Contract E(10-1)-1375)
(ANCR-1226) Avail: NTIS HC $6.00

The economic production of electrical power from high temperature steam and liquid dominated geothermal resources has been demonstrated. Large quantities of geothermal energy are considered to exist at moderate temperatures, however, the economics of converting this energy into electricity has not been established. Design concepts are presented of a dual boiler isobutane cycle selected for use with the moderate temperature hydrothermal resource and presents a cost estimate for a 10 and 50 MW power plant. Cost of electrical power from these plants is estimated and compared with that from coal, oil and nuclear plants. The impact of selling a portion of the residual heat in the geothermal effluent is assessed. Author (ERA)

N76-31689# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY PROBLEMS AND POTENTIAL SOLUTIONS
L. C. Schmid 16 Oct. 1975 13 p
(Contract E(45-1)-1830)
(BNWL-SA-5622) Avail: NTIS HC $3.50

The past and future trends in energy use show a greater growth rate for oil and gas relative to other resources, and reserves of these resources are not being found as rapidly as they are being removed from the ground, resulting in greater dependence of imported Eastern oil. This has resulted in a trade imbalance. These factors are resulting in some current shortages of energy, especially electrical power and natural gas; increasing energy costs; a growing dependence on foreign supplies of fuel; and increased consideration of the social and environmental aspects of energy production, as well as technical and economic ones. In the short and intermediate term, logical solutions based on the energy scenario are to reduce energy demand through conservation; to move away from using scarce resources such as oil and gas which now provide approximately 78% of U. S. energy; to move toward the use of more abundant resources such as coal and uranium; and to develop domestic supplies of oil and gas. In the longer term, renewable sources such as solar, fusion, and geothermal need to be developed. ERA

N76-31690# Kernforschungszentrum, Karlsruhe (West Germany).
POSSIBILITIES OF ENERGY RECUPERATION BY GRAVITY TRACTION IN PUBLIC TRANSIT SYSTEMS
V. Jung Dec. 1975 50 p refs in GERMAN; ENGLISH summary
(KFK-1793) Avail: ERDA Depository Libraries HC $4.00

About 70 or 80 percent of the traction energy employed in the operation of metropolitan and suburban railways on lines with the stops arranged at short intervals are used for the kinetic energy of the vehicles. If at all, this energy is recuperated only at a rate of approximately 30 percent. Gravity traction allows the kinetic energy of the vehicles to be recuperated at a rate of about 90 percent during deceleration, which would decrease the overall energy input by 63 to 72 percent. However, this requires the line to be arranged uphill and downhill, and a traction system not based on the interaction of forces between a wheel and a rail might be needed. The result would be high average speeds, without requiring more traction power. A relationship is established between the parameters of the trackway and the change of the vertical and horizontal acceleration values as a function of time. Author (ERA)

N76-31691# Institute of Gas Technology, Chicago, Ill.
AUTOMOTIVE STORAGE OF HYDROGEN AS A MIXTURE OF METHANOL AND WATER Final Report
F. L. Kester, A. J. Konopka, and E. Camara Nov. 1975 70 p refs Sponsored in part by ERDA
(Contract EPA-68-03-2057)
(TEC-75/004) Avail: NTIS HC $5.00

The concept of steam-reforming methanol on-board an automobile was evaluated as a candidate method of storing fuel for the hydrogen engine. This method uses low-temperature, engine waste heat to evaporate a 1:1 molar water-methanol mixture at 373 K (212 F) and to provide endothermic reaction heat at 505 K (450 F) to convert this mixture to hydrogen and carbon dioxide. Defining system efficiency as the product of the generator chemical efficiency and the engine thermal efficiency yields a value of 32.4 percent. Conservative estimates indicate that an additional volume of 44 to 49 liters and an additional weight of 110 to 140 kg would be required, compared with a conventional 20 gal gasoline tank. A 500 hour endurance test of this system with a Girdler G-66B catalyst was conducted at 505 K (450 F), atmospheric pressure, and low space velocity--compared with automotive requirements--at wide-open-throttle conditions with laboratory-grade methanol; there was no loss of activity. However, when fuel-grade methanol containing small amounts of higher alcohols was substituted for the laboratory-grade methanol, significant catalyst deactivation occurred.
Author (ERA)

N76-31692# Escher Technology Associates, St. Johns, Mich.
HYDROGEN-FUELED INTERNAL COMBUSTION ENGINE, A TECHNICAL SURVEY OF CONTEMPORARY US PROJECTS
W. J. D. Escher Sep. 1975 122 p refs Sponsored by ERDA (TEC-75/005) Avail: NTIS HC $5.45

Over the past five years, fourteen hydrogen engine research groups, with a wide range of backgrounds and organizational makeup, were found to have conducted experimental work of significance. Some 49 hydrogen-air and hydrogen-oxygen internal combustion engines of both the piston and rotary combustion types are included in the resulting survey. Several of the organizations (over half) developed demonstration hydrogen-fueled vehicles; 15 of these were documented as well. Onboard hydrogen storage systems of the pressurized gas, cryogenic liquid, and metal hydride types were successfully employed. A wide range of technical options were explored in the various research engines, especially in the technique and equipment employed in hydrogen admission to the engines. The hydrogen engine's propensity for producing relatively high amounts of oxides of nitrogen (NO/sub x/) emissions when operated at high power settings was noted and, in the case of several of the projects, accurately quantified. Author (ERA)

N76-31693*# Battelle Columbus Labs., Ohio.
STUDIES OF ENCAPSULANT MATERIALS FOR TERRESTRIAL SOLAR-CELL ARRAYS Quarterly Progress Report 9 Oct. - 9 Dec. 1975
D. C. Carmichael, comp. 22 Dec. 1975 24 p Prepared for JPL Sponsored in part by ERDA
(Contract NAS7-100)
(NASA-CR-148816; ERDA/JPL-954328-75/1; QPR-1) Avail: NTIS HC $3.50

Study 1 of this contract is entitled "Evaluation of World Experience and Properties of Materials for Encapsulation of Terrestrial Solar-Cell Arrays." The approach of this study is to review and analyze world experience and to compile data on properties of encapsulants for photovoltaic cells and for related applications. The objective of the effort is to recommend candidate materials and processes for encapsulating terrestrial photovoltaic arrays at low cost for a service life greater than 20 years. The objectives of Study 2, "Definition of Encapsulant Service Environments and Test Conditions," are to develop the climatic/environmental data required to define the frequency and duration of detrimental environmental conditions in a 20-year array lifetime and to develop a corresponding test schedule for encapsulant systems. ERA

N76-31694*# Simulation Physics, Inc., Burlington, Mass.
DEVELOPMENT OF METHODS AND PROCEDURES FOR HIGH RATE LOW ENERGY EXPENDITURE FABRICATION OF SOLAR CELLS Quarterly Progress Report, 1 Sep. - 31 Dec. 1975
A. R. Kirkpatrick and J. A. Minnucci Jan. 1976 14 p Prepared for JPL Sponsored in part by ERDA
(Contract JPL-954289)
(NASA-CR-148817; ERDA/JPL-954289-75/1; QPR-1) Avail: NTIS HC $3.50 CSCL 10A

The objective of this program is to develop high rate, energy efficient solar cell processing techniques based around ion implantation and elimination of all conventional thermal operations. Cells have been fabricated using an abbreviated series of vacuum process operations performed at room temperature. Author (ERA)

N76-31695# Denver Research Inst., Colo.
A DETAILED ANALYSIS OF THE HYDRIDING CHARACTERISTICS OF LaNi5 Interim Report
C. E. Lundin and F. E. Lynch 1975 7 p refs Presented at the 10th IECES Conf., 1975
(Contract F44620-74-C-0020; AF Proj. 9750)
(AD-A023394; AFOSR-76-0432TR) Avail: NTIS CSCL 07/4

Precise determinations of pressure-temperature-composition relationships in absorption and desorption where obtained for the LaNi5-H system. Hysteresis effects are discussed and desorption kinetics data are presented. Several parameters are found to differ significantly from previously reported values. Author (GRA)

N76-31696# Boston Univ., Mass.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
Norman N. Lichtin 9 May 1975 17 p refs
(Grant NSF AER-72-03597-A03)
(PB-252962/6; NSF/RA/N-75-250; NSF/RANN/SE/AER72-03597-75-1) Avail: NTIS HC $3.50 CSCL 07E

Reverse-bias experiments with the iron-thionine thin layer-totally illumined photogalvanic cell with SnO2 and Pt electrodes (TI-TL SnO2/Pt cell) indicated that output is not limited by electrode activation processes. In solutions acidified with H2SO4, Fe(II) reduces triplet methylene blue 12 times faster in 50 v/v percent aq. CH3CN than in water while the rate of unimolecular decay of the triplet is unaffected by the change in solvent. Reduction of the triplet by FE(II) is four times faster when sulfate is the only anion in solution than in the presence of TFMS(-). Oxidation of methylene blue semiquinone by FE(III) is six times slower in acidified 50 v/v percent aq. CH3CN than in acidified water. Output of the TI-TL SnO2/Pt iron-thionine cell is greater with sulfuric acid than other acids. Significant outputs were obtained when Co-(II) EDTA/Co (III) EDTA or hydroquinone/quinone were substituded for Fe(II)/Fe(III) in the TI-TL SnO2/Pt cell. GRA

N76-31697# Stanford Research Inst., Menlo Park, Calif.
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADE-OFFS. VOLUME 1: SUMMARY OF VOLUMES 2-4 Energy and Environment Series
Nov. 1975 29 p
(Contract EPA-68-01-2469)
(PB-250000/7) Avail: NTIS HC $4.00; HC also available in set of 4 reports as PB-249999-set, HC $18.00 CSCL 13B

This volume provides a brief summary of volumes 2 through 4 of the series. The background papers include: technical overview; social impacts of energy development in a rural area: a case example of western coal development; water availability and consumption for energy; water pollution potential of energy conversion processes; and air pollution impacts of energy processes. GRA

N76-31698# Stanford Research Inst., Menlo Park, Calif.
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADE-OFFS. VOLUME 3: RELATIVE ENVIRONMENTAL RANKING OF PROPOSED OFFSHORE CONTINENTAL SHELF AREAS ON THE BASIS OF IMPACTS OF OIL SPILLS Energy and Environment Series
Patrick J. Kinney, Phillip D. Carpenter, Mark D. Levine, and Steven H. Traver Sep. 1975 71 p refs
(Contract EPA-68-01-2469)
(PB-250002/3) Avail: NTIS HC $4.50; HC also available in set of 4 reports as PB-249999-set, HC $18.00 CSCL 13B

Environmental impacts resulting from offshore oil development are considered for phytoplankton, zooplankton, benthic biota, fish, marine mammals, and birds. Shore-related effects are also covered. The relative probability of oil spills occurring because of earthquakes, tsunamis, and severe storms is discussed. GRA

N76-31699# Stanford Research Inst., Menlo Park, Calif.
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADE-OFFS. VOLUME 4: BACKGROUND PAPERS Energy and Environment Series
Mark D. Levine, Robert V. Steele, and Irving W. Yabroff Oct. 1975 132 p refs
(Contract EPA-68-01-2469; SRI Proj. 3563)
(PB-250003/1) Avail: NTIS HC $6.00 CSCL 13B

Background information directly relevant to the analysis of environmental tradeoffs among the different measures to increase U.S. energy supply is presented. Subject areas covered include: Technological Overview; Social Impacts of Energy Development in a Rural Area: A Case Example of Western Coal Development; Water Availability and Consumption for Energy; Water Pollution Potential of Energy Conversion Processes; and Air Pollution Impacts of Energy Processes. GRA

N76-31700# Office of Technology Assessment, Washington, D.C.
ENERGY, THE ECONOMY AND MASS TRANSIT

Dec. 1975 155 p refs Prepared in cooperation with Skidmore, Owings and Merrill, Washington, D. C., and System Design Concepts, Inc., Washington, D. C.
(PB-250624/4; OTA-T-15) Avail: NTIS $6.75 CSCL 13B

The report examines: (1) the probable effects of changes in energy supplies and prices on transit patronage and the transit industry; (2) the potential role of public mass transit programs in stimulating a depressed economy; and (3) the effect on the economy and on urban transit if transit funds were sharply reduced. The study also evaluates alternative transportation policies for responding to various economic and energy conditions and examines within this framework the effect of transit incentives and automobile disincentives on transit patronage and automobile use. This assessment was performed in response to a request from the Committee on Appropriations, U.S. Senate. GRA

N76-31701# Federal Energy Administration, Washington, D.C.
ENERGY INFORMATION REPORT TO CONGRESS REQUIRED BY PUBLIC LAW 93-319, AMENDED BY PUBLIC LAW 94-163. THIRD QUARTER 1975
1975 138 p ref Sponsored by National Energy Information Center, Washington, D. C.
(PB-242760-03; FEA/B-75/693; QR-3) Avail: NTIS HC $10.00; HC also available on subscription $35.00/year domestic, $45.00/year foreign CSCL 10A

Resource development, coal, natural gas, crude oil, refined petroleum products, nuclear energy, and electric power are discussed. Topic areas cover such things as production, consumption, imports, exports, and reserves. GRA

N76-31702# Delaware Univ., Newark. Inst. of Energy Conversion.
DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
K. W. Boer May 1975 53 p refs
(Grant NSF AER-72-03478-A03)
(PB-252961/8; NSF/RANN/AER72-03478/PR-75-1; NSF/RA/N-75-182; QPR-1) Avail: NTIS HC $14.50 CSCL 10B

Cell processing has improved to the point whereby large (55 sq cm) and small (4 sq cm) Cu2S/CdS cells can be made with rooftop efficiencies in excess of 6 percent. Improved instrumentation and a better understanding of experimental techniques resulted in 85 percent yield during a simulated production run in the Pilot Line. The energy dispersive X-ray analyzer is capable of making scans on Cu2S surfaces. This tool can now be used to characterize structural and stoichiometric changes that occur in the Cu(x)S during cell processing and subsequent aging. Research has continued related to the application of Auger analysis to the heterojunction region. Cell lifetime, degradation and regeneration studies have continued. Cell theoretical analysis has dealt with the photovoltaic response and its dependence on such parameters as Cu2S thickness and absorption, electron diffusion length, surface recombination velocity, and drift fields. GRA

N76-31703# Martin Marietta Labs., Baltimore, Md.
BIOLOGICAL SOLAR ENERGY CONVERSION: APPROACHES TO OVERCOME YIELD, STABILITY AND PRODUCT LIMITATIONS ProgressReport, 1 Apr. - 30 Sep. 1975
Bessel Kok, C. F. Fowler, H. H. Hardt, and R. J. Radmer Sep. 1975 44 p refs
(Grant NSF AER-73-03291)
(PB-252925/3; MML-TR-75-38C; PR-1) Avail: NTIS HC $4.00 CSCL 06A

The stability of electron transport was studied during aging of isolated chloroplasts with and without gluteraldehyde fixation. Photosystem 1 activity proved quites stable - as expected. Photosystem 2 activity was more labile; it had a half life about 3 days at 4, about 1 day at 20 degrees. The site most sensitive to aging proved to be close to the photochemical apparatus of System 2 (rather than the O2 evolution system or the chain between the photoacts). Gluteraldehyde treatment caused an about 5 fold decline of the O2 evolution capacity with hydrophillic electron acceptors. System 1 activity was decreased to the same extent. Little inhibition was observed with the lipophilic acceptor p-phenylenediamine. Gluteraldehyde treatment slowed down the decay of photochemical (O2 evolution) activity during dark storage of chloroplasts to half lives of about 20 days at 4 and about 3 days at 20 degrees. A mass spectrometer system was assembled to measure exchange in algae. Adapted algae showed high rates of H-D exchange (hydrogenase activity). GRA

N76-31704# Council on Environmental Quality, Washington, D.C.
REPORT ON 1975 PUBLIC HEARINGS. ENVIRONMENTAL EFFECTS AND ENERGY CONSERVATION ASPECTS OF THE NONNUCLEAR ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAMS, WASHINGTON, D. C., 3-4 SEPTEMBER 1975 LOS ANGELES, 8-9 SEPTEMBER 1975, DETROIT, 11-12 SEPTEMBER 1975
Jan. 1976 88 p refs
(Contract EQ5AC027)
(PB-249696/6; EQ-517513027) Avail: NTIS HC $5.00 CSCL 10A

Testimony submitted to the Council on Environmental Quality during public hearings in September, 1975, on Environmental Effects and Energy Conservation Aspects of the Nonnuclear Energy Research, Development and Demonstration Programs (RD and D), in concurrence with Public Law 93-577 is summarized. The report synthesizes the major trends in the testimony and dialogue on the general subject of the overall ERDA plan, conservation RD and D, environment and energy, and the Federal role in energy RD and D. GRA

N76-31705# Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
COAL CONVERSION PROGRAM. FINAL ENVIRONMENTAL STATEMENTS. (ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT OF 1974, SECTION 2)
Apr. 1975 573 p refs
(PB-250104/7; FEA/G-75/392; FES-75-1) Avail: NTIS HC $13.50 CSCL 10A

The special authorities delegated to FEA by the Energy Supply and Environmental Coordination Act of 1974 in relation to converting certain power plants and major fuel burning installations from petroleum to coal as a source of energy are described. The current national environment in which coal conversion will take place; assessment and availability of pollution control equipment; critical air pollutants most directly affected by the Act, including the effects of coal supply, coal quality, and the availability of pollution control equipment; adverse effects of coal utilization; energy implications and environmental impacts of conversion; economic impact of programs to convert existing power plants; and the potential of coal supplies available for conversion are discussed. GRA

N76-31706# Mitre Corp., McLean, Va.
WIND MACHINES
Frank R. Eldridge Oct. 1975 85 p refs
(Grant NSF AER-75-12937)
(PB-249936/6; NSF/RA/N-75-051; MTR-6971) Avail: NTIS HC $5.00 CSCL 10B

A brief survey of the viability, history, taxonomy, and future potential of various types and sizes of wind machines that might be used to help meet future U.S. energy demands is presented. It also discusses various applications of wind machines, as well as siting problems, performance characteristics, and system designs. A glossary of commonly used words and phrases, a list of suppliers, and a selected bibliography are included. GRA

N76-31707# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
KENTUCKY ENERGY RESOURCES UTILIZATION PROGRAM Quarterly Progress Report, 1 Apr. - 30 Jun. 1975
Sep. 1975 39 p refs
(PB-250687/1; IMMR5-PRI-75) Avail: NTIS HC $4.00 CSCL 08I

Progress is reported on the Kentucky Energy Resource Utilization Program during the three-month period ending June 30, 1975. The projects are grouped into the areas of Mining, including manpower development and technological projects, Process Development which includes studies on gasification and liquefaction and the improvement of ancillary processes associated

with these operations, and Geology and Reserves which includes projects aimed at accelerating the evaluation of the Kentucky coal reserves and projects in reclamation and environmental effects. GRA

N76-31708# Cameron Engineers, Inc., Denver, Colo.
A TECHNICAL AND ECONOMIC STUDY OF CANDIDATE UNDERGROUND MINING SYSTEMS FOR DEEP, THICK OIL SHALE DEPOSITS, PHASE 1 Contract Report, Jul. 1974 - Jul. 1975
William, N. Hoskins, F. D. Wright, R. L. Tobie, J. B. Bills, R. P. Upadhyay, and C. B. Sandberg Jul. 1975 323 p refs
(Contract DI-BM-SO-241074)
(PB-249884/8; BM-OFR-23-76) Avail: NTIS HC $9.75 CSCL 08I

Methods of large-scale mining of the thick oil shale deposits in the deep central part of the Piceance Creek Basin of Northwestern Colorado are evaluated. Technical and economic data were obtained, preliminary layouts and designs were prepared, and pertinent operating features and cost data were analyzed and evaluated. The relative merits of each mining method are defined. GRA

N76-31709# New York Sea Grant Inst., Albany.
ELECTRICITY GENERATION AND OIL REFINING
H. G. Mike Jones, Harold Bronheim, and Philip F. Palmedo Jul. 1975 26 p refs Prepared in part by Brookhaven Natl. Lab.
(PB-249755/0; NYSSGP-AM-75-016; Atlas-Mono-25; NOAA-76011604) Avail: NTIS HC $4.00 CSCL 10A

Present energy supplies and demands in the New York Bight region are summarized. Discussed are energy consumption, production capacity, and future requirements. GRA

N76-31710# Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
TRENDS IN REFINERY CAPACITY AND UTILIZATION-PETROLEUM REFINERIES IN THE UNITED STATES-FOREIGN REFINERY EXPORTING CENTERS. AN INTERIM UPDATE FOR US PORTION ONLY
Eugene Peer Dec. 1975 22 p
(PB-250062/7; FEA/G-75/710) Avail: NTIS HC $3.50 CSCL 07A

Reasons for the increase in crude oil imports are discussed, such as the two tier crude pricing system and the entitlements program. The decrease in imports of petroleum products are due to the economic situation, decreased demand, lack of Government policy, changes in oil import policies, rapid inflation, and soaring refinery costs. The report contains numerous tables which illustrate these trends. GRA

N76-31711# Little (Arthur D.), Inc., Cambridge, Mass.
RESEARCH AND DEVELOPMENT IN TRANSMISSION AND DISTRIBUTION FOR THE ELECTRIC UTILITY INDUSTRY Final Report, 1 Jan. - 30 Nov. 1975
James Nicol, John J. Bzura, E. Schwarm, and B. Underhill Jan. 1976 122 p
(Grant NSF C-929)
(PB-252450/2; ADL-77929) Avail: NTIS HC $5.50 CSCL 05A

The study was performed to determine how federal support may be used most effectively in research and development of transmission and distribution systems for the electric power industry. Chapter I presents a brief survey of important technological developments in T and D (transmission and distribution) along with statistical data on T and D systems in the United States from 1944 to the present time, with forecasts to 1980. The discussion makes it clear that electrical equipment manufacturers were primarily responsible for R and D up to the early 1970's. Chapter II is a financial survey and analysis of T and D equipment manufacturers. Load growth and its effects on the industry are discussed. Chapter III describes the types of R and D facilities currently engaged in work on T and D systems and lists major facilities in the United States, Europe and Japan. Chapter IV contains both a discussion of historical R and D trends in the industry and recommendations for federal R and D policy in the future. GRA

N76-31712# Rutgers Univ., New Brunswick, N.J. Dept. of Electrical Engineering.
SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Annual Progress Report, 1 Jun. - 31 Dec. 1975
Wayne A. Anderson Jan. 1976 37 p refs
(Grant NSF AER-73-03197)
(PB-252833/9; NSF/RANN/SE/AER73-03197/PR-75; NSF/RA-760014) Avail: NTIS HC $4.00 CSCL 10B

The optimum process for fabricating Schottky Barrier Solar cells (SBSC) is reported. Current flow mechanisms are controlled using different interfacial oxide thicknesses. A slower Cr deposition rate produces consistently high V sub oc (0.48-0.52 V). Surface state density is calculated from capacitance and conductance measurement. Thin epitaxial silicon films 20-30 micrometers generate 18mA/sq cm short circuit current density compared to a maximum of 25mA/sq cm on thick silicon using AM2 illumination. Polycrystallin silicon films have been electron beam deposited on stainless steel. Other studies involve environmental effects, concentration of sunlight, a new solar simulator, optical analyses, and surface analysis. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-31713 Washington Univ., Seattle.
DESIGN OF MONITORING SYSTEMS FOR THE DETECTION OF TRENDS IN STREAM QUALITY Ph.D. Thesis
Dennis Patrick Lettenmaier 1975 216 p
Avail: Univ. Microfilms Order No. 76-17547

An approach to the design of monitoring systems for the detection of trends in stream water quality is presented which yields both sample station locations and sampling frequencies for a set constraint on the monitoring effort for a river basin. The method for determining sample frequency at a given station is based on nonparametric tests for trend to time series with any correlation structure. Records of daily water quality measurements show that a lag one Markov model is generally adequate for parameterization of the persistence of these time series of water quality indicators. Normalized curves for trend detection power are derived as a function of trend magnitude, sample size, and time series standard deviation for lag one Markov models with assumed lag correlation coefficients in the range provided by the historic data. The time series variance is assumed to consist of an historic (meteorologically driven) component and a measurement and prediction component resulting from estimation of water quality levels at arbitrary locations. Dissert. Abstr.

N76-31714* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR DETECTING POLLUTANTS Patent
Robert S. Rogowski, Ralph R. Richards (Old Dominion Univ.), and Edmund J. Conway, inventors (to NASA) Issued 31 Aug. 1976 7 p Filed 30 Dec. 1974 Supersedes N75-15938 (13 - 07, P 0771)
(NASA-Case-LAR-11405-1; US-Patent-3,977,831; US-Patent-Appl-SN-537480; US-Patent-Class-23-232E; US-Patent-Class-23-230R; US-Patent-Class-23-232R) Avail: US Patent Office CSCL 13B

A method is described for detecting and measuring trace amounts of pollutants of the group consisting of ozone, nitrogen dioxide, and carbon monoxide in a gaseous environment. A sample organic solid material that will undergo a chemical reaction with the test pollutant is exposed to the test environment and thereafter, when heated in the temperature range of 100-200 C., undergoes chemiluminescence that is measured and recorded as a function of concentration of the test pollutant. The chemiluminescence of the solid organic material is specific to the pollutant being tested. Official Gazette of the U.S. Patent Office

N76-31715# Oak Ridge National Lab., Tenn.
ECOLOGY AND ANALYSIS OF TRACE CONTAMINANTS Progress Report, Oct. 1974 - Dec. 1975
R. I. VanHook, ed. and W. D. Shults, ed. Feb. 1976 200 p refs

(Contract W-7405-eng-26)
(ORNL-NSF-EATC-22) Avail: NTIS HC $8.75

A major effort in the ORNL Ecology and Analysis of Trace Contaminants program has been concerned with the development of a Unified Transport Model (UTM) which can be used to describe and predict the transport and fate of trace contaminants through the atmospheric, terrestrial, and aquatic environments. In concept the air, land, and aquatic systems are represented by three major model components, designed to be run in sequence. A suite of compatible submodels that can be assembled into a UTM to meet specific user requirements, (i.e., to meet researcher needs or management needs), was developed. This research has required new models, and application of the UTM and/or its components. Author (ERA)

N76-31716# Energy Research and Development Administration, Bartlesville, Okla.
INSTRUMENTAL PRACTICE IN THE CVS METHOD OF EXHAUST EMISSION MEASUREMENT
R. W. Hurn 1975 10 p Presented at the Fuels and Lubricants Meeting, Houston, Tex., 3 Jun. 1975 Sponsored by ERDA
(CONF-750681-1) Avail: NTIS HC $4.00

The SAE paper is intended to describe, and to a limited extent review, a more comprehensive document on instrumental practice. The parent document was prepared for the Coordinating Research Council for use as a reference guide to good practice in selection and use of instruments for measurement of auto emissions. The summary paper includes information regarding instrumental principles wherein such information is deemed helpful in understanding practical problems and sources of measurement error or variability. Other than for the brief review of instruments principles, the summary paper is devoted primarily to describing the context of the parent document in covering selection, calibration, and good operating practice of instruments used in the constant volume sampling method of exhaust emissions measurement. Author (ERA)

N76-31717# Los Alamos Scientific Lab., N.Mex.
CURRENT TECHNOLOGY IN SAMPLING FOR AIRBORNE RADIONUCLIDES
H. F. Schulte 1976 12 p refs Proc. of short course on Radionuclides in the Environment, Palo Alto, Calif., 22 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-76-123; Conf-751174-1) Avail: NTIS HC $3.50

Sampling for airborne radionuclides is an important part of assessing the occupational environment and the public or out-plant environment. Both of these are important to the operation of any nuclear facility. Most such facilities do not emit radionuclides continuously to any extent, and hence both the occupational and environmental sampling system is designed to detect deviations from normal conditions or untoward events. Work with materials of a low degree of radioactivity or with nonradioactive materials may involve operations which are not enclosed, and significant contaminating material may always exist in the air. In this case, the sampling is directed toward measuring this ambient level and assessing its continued impact on the worker and on the environment. Within the plant, needs for sampling are often suggested by surface monitoring results and by bioassay, and outside by analysis of plants, soils, and material from fallout trays. Author (NSA)

N76-31718# Los Alamos Scientific Lab., N.Mex.
DEVELOPMENT OF AIR-MONITORING TECHNIQUES USING SOLID SORBENTS Progress Report, 1 Apr. - 30 Sep. 1975
G. O. Wood and R. G. Anderson Feb. 1976 13 p refs
(Contract W-7405-eng-36)
(LA-6216-PR; NIOSH-IA-75-31) Avail: NTIS HC $4.50

Methods for air sampling and analysis of four groups of organic compounds were studied. The compounds include: (1) low boiling aliphatic amines, (2) low boiling hydrazines, (3) pyridines, and (4) formaldehyde. Vapors are collected on a solid sorbent in a tube through which air is drawn. Retention of n-butylamine, pyridine, and 1,1-dimethylhydrazine was measured for several sorbents. The most effective is sulfuric acid-coated silica gel. The sample is removed from the selected sorbent by elution with a solvent. Desorptions of seven aliphatic amines from silica gel, of pyridine from porous polymers and sulfuric acid-coated silica gel, and of formaldehyde from alumina were studied. A gas chromatographic method was developed for pyridine and 2-amino-pyridine analysis. Storage of formaldehyde collected on alumina was measured. The rapid loss observed limits the sampling period to 30 min and requires immediate elution. Alumina tubes and bubblers were compared for sampling formaldehyde vapors in air. NSA

N76-31719# Battelle Pacific Northwest Labs., Richland, Wash.
COMPUTER SYSTEM FOR ENVIRONMENTAL SAMPLE ANALYSIS AND DATA STORAGE AND ANALYSIS
F. P. Brauer and J. E. Fager 15 Sep. 1975 24 p refs Presented at Nucl. Sci. Symp., San Francisco, 17 Nov. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5421; Conf-751116-27) Avail: NTIS HC $4.50

A minicomputer based environmental sample analysis and data storage system has been developed. The system is used for analytical data acquisition, computation, storage of analytical results, and tabulation of selected or derived results for data analysis, interpretation and reporting. This paper discusses the structure, performance and applications of the system. Author (NSA)

N76-31720# Los Alamos Scientific Lab., N.Mex.
MONTE CARLO SIMULATION OF THE TURBULENT TRANSPORT OF AIRBORNE CONTAMINANTS
C. W. Watson and S. Barr Sep. 1975 28 p refs
(Contract W-7405-eng-36)
(LA-6103) Avail: NTIS HC $4.00

A generalized, three dimensional Monte Carlo model and computer code (SPOOR) are described for simulating atmospheric transport and dispersal of small pollutant clouds. A cloud is represented by a large number of particles that is tracked by statistically sampling simulated wind and turbulence fields. These fields are based on generalized wind data for large scale flow and turbulent energy spectra for the micro- and mesoscales. The large scale field can be input from a climatological data base, or by means of real time analyses, or from a separate, subjectively defined data base. Micro- and mesoscale wind fluctuations are introduced through a power spectral density, to include effects from a broad spectrum of turbulent energy scales. The role of turbulence is simulated in both meander and dispersal. Complex flow fields and time dependent diffusion rates are accounted for naturally, and shear effects are simulated automatically in the ensemble of particle trajectories. Author (NSA)

N76-31721# Battelle Pacific Northwest Labs., Richland, Wash.
MULTIELEMENT CHARACTERIZATION OF ATMOSPHERIC POLLUTANTS BY X-RAY FLUORESCENCE ANALYSIS AND INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS
L. A. Rancitelli and T. M. Tanner Jan. 1976 41 p refs Presented at Symp. on the Develop. of Nuclear-Based Techniques, Vienna, 15 Mar. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5610; Conf-760311-2) Avail: NTIS HC $4.00

The simultaneous measurement of a wide spectrum of elements in aerosols collected on air filters and in rain water can yield information on the origin, transport, and removal of atmospheric pollutants. In order to determine the elemental content of these aerosols, a pair of highly sensitive, precise and complementing instrumental techniques, X-ray fluorescence and neutron activation analysis, have been developed and employed. Data are presented on the results of combined X-ray fluorescence and activation analysis of aerosols collected in a number of urban areas of the U.S.A. and from the 80th median sampling network in March 1972. From a comparison of these ratios in granite and diabase with those of filters placed in urban areas, it is evident that Zn, Se, Sb, Hg, and Pb levels have been increased by as much as several orders of magnitude. Al, Co, La, Fe, Eu, Sm, Tb, Ta, Hf, and Th appear to exist at levels compatible with an earth's crust origin. Author (NSA)

N76-31722# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
REMOTE SENSING OF OIL SLICKS WITH MICROWAVE RADIOMETER

Kimmo Kaski and Antti Laeaeperi 1976 18 p refs
(Rept-S-83; ISBN-951-750-634-1) Avail: NTIS HC $3.50

The microwave radiometer was used to detect the oil slick on the surface of the sea, to map the volume, thickness and total area of the oil slick, and to identify the oil type. Its performance is assessed using experimental results from helicopter flight over the Baltic Sea with flying altitudes from 10 to 30 m at speeds from 10 sea miles/h to 30 sea miles/h. ESA

N76-31723# European Space Agency, Paris (France).
THE DFVLR LIDAR SYSTEM 5
Christian Werner Apr. 1976 50 p refs Transl. into ENGLISH of 'Das DFVLR-Lidar-System 5', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-Mitt-75-17, 23 Sep. 1975 Original German report available from DFVLR, Cologne DM 16.80
(ESA-TT-278; DLR-Mitt-75-17) Avail: NTIS HC $4.00

The system developed under contract of the Ministry of Technology of the Federal Republic of Germany is described. It is to be used for environmental protection (aerosol content of the atmosphere). The Lidar system consists of a ruby laser and a Newtonian telescope. It is mounted on a scanning pedestal. Each step in azimuth and elevation can be selected by stepping motors. An automatic data acquisition system is used for storing the data on magnetic tape. Author (ESA)

N76-31724# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF A BUOY MOUNTED HYDROCARBON VAPOR SENSORS FOR USE IN LOCAL AREA POLLUTION SURVEILLANCE SYSTEM Interim Report, Jul. 1973 - Jun. 1975
Louis H. Goodson, William B. Jacobs, and Sandra Puent Jul. 1975 112 p refs
(Contract DOT-CG-34320-A; MRI Proj. 34320-A)
(AD-A022855; USCG-D-10-76) Avail: NTIS CSCL 13/2

The feasibility of using hydrocarbon vapor sensors on buoys along watercourses for the signalling of oil spills on a real time basis has been investigated. As a result of laboratory testing of five types of vapor sensors, it was concluded that the Taguchi Semiconductor Gas Sensor (TGS) was promising for this application. Two other vapor sensors selected by the U.S. Coast Guard for further investigation were the Esso oil on water piezoelectric sensor and the Environmental Measurement Systems' Adhistor sensor (WSM-350). These three sensors were evaluated in the laboratory, in the rooftop environment, and in a lake environment. The TGS sensor and the Adhistor sensor were also investigated in the marine environment. Recommendations for further testing and evaluation of the TGS sensor on buoys are made. Author (GRA)

N76-31725# Grumman Ecosystems Corp., Bethpage, N.Y.
OCEANOGRAPHIC STUDIES TO ASSESS THE ENVIRONMENTAL IMPLICATIONS OF OFFSHORE SITING OF ELECTRIC GENERATING FACILITIES: NEW YORK FIELD STUDIES, 1973 - 1974 Final Report
Nov. 1975 466 p refs Prepared in cooperation with Lawler, Matusky and Skelly Engineers, Tappan, N. Y.
(PB-250384/5; NYSERDA-75/15) Avail: NTIS HC $12.00 CSCL 13B

Physical, chemical and biological data were collected concurrently over an 800-square mile area of the New York Bight, south of Long Island, during the period November 1973 to October 1974. The objectives of the study were to determine significant differences within the study area that might affect the suitability of siting an offshore power plant and to characterize the physical, chemical, and biological conditions and processes in the study area. GRA

N76-31726# Pittsburgh Univ., Pa. Dept. of Civil Engineering.
A REGIONAL APPROACH TO DECISION MAKING IN THE REGIONALIZATION OF WASTEWATER TREATMENT SYSTEMS Research Report
Dennis W. Weeter and James G. Belardi May 1975 90 p refs
(Contract DI-14-31-0001-5038)
(PB-250749/9; SETEC-CE-75-01; W76-05251; OWRT-A-035-PA(1)) Avail: NTIS HC $5.00 CSCL 13B

The concept of regionalization as it applied to planning of wastewater treatment and collection facilities is introduced. Generally, the problem is to find the minimum cost alternative for the location and number of treatment plants given a discrete set of wastewater generators. Literature solutions to the regionalization problem are reviewed for possible application to regional areas in Southwestern Pennsylvania. Modifications were made to improve the neuristic algorithm of McCouagha and Converse. The improved algorithm was applied to two case study regions. Results from the algorithm were compared to results obtained by an iterative approach used by Southwestern Pennsylvania Regional Planning Commission. Sensitivity analyses performed on the improved neuristic algorithm indicate a wide range of uncertainty in cost estimation. GRA

N76-31727# GCA Corp., Bedford, Mass. GCA Technology Div.
MODEL VALIDATION AND TIME-CONCENTRATION ANALYSIS OF THREE POWER PLANTS Final Report
Michael T. Mills and Roger W. Stern Dec. 1975 154 p refs
(Contract EPA-68-02-1376)
(PB-250685/5; GCA-TR-75-30-G; EPA-450/3-76-002) Avail: NTIS HC $6.75 CSCL 13B

An analysis is reported of the EPA single source model using SO2 concentration and meteorological data collected in the vicinity of three Ohio power plants. The model predicts the upper percentile of the frequency distribution of 1 hour and 3 hour concentrations reasonably well. GRA

N76-31728# Pacific Environmental Services, Inc., Santa Monica, Calif.
DESIGN AND OPERATING PARAMETERS FOR EMISSION CONTROL STUDIES: ASARCO, EL PASO, COPPER SMELTER Final Report, Apr. - Oct. 1975
I. J. Weisenberg Feb. 1976 35 p refs
(PB-251762/1; EPA-600/2-76-036i) Avail: NTIS HC $4.00 CSCL 07A

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. GRA

N76-31729# Midwest Research Inst., Kansas City, Mo.
STUDY ON CHEMICAL SUBSTANCES FROM INFORMATION CONCERNING THE MANUFACTURE, DISTRIBUTION, USE, DISPOSAL, ALTERNATIVES, AND MAGNITUDE OF EXPOSURE TO THE ENVIRONMENT AND MAN. TASK 2: THE MANUFACTURE AND USE OF SELECTED ALKYLTIN COMPOUNDS Final Report
Thomas W. Lapp Apr. 1976 129 p refs
(PB-251819/9; EPA-560/6-76-011) Avail: NTIS HC $6.00 CSCL 07A

Production methods, importation, exportation, use patterns, and exposure to man and the environment for selected alkyltin compounds from 1965 to 1974 are identified. Only organotin compounds having alkyl groups with eight carbon atoms or less attached to the tin were considered. Data for the production methods included the specific process, raw materials, annual production quantities, major manufacturers, waste products, environmental management of process wastes, and other production data. Use patterns were identified and annual consumption data were compiled for each compound in the respective areas of utilization. GRA

N76-31730# National Academy of Sciences - National Research Council, Washington, D.C.
SELENIUM Final Report
Jan. 1976 320 p refs
(Contract EPA-68-02-1226)
(PB-251318/2; EPA-600/1-76-014) Avail: NTIS HC $9.75 CSCL 06T

The report is an in-depth study that attempts to assemble, organize, and interpret present-day information on selenium and its compounds, and the effects of these substances on man, animals, and plants. Emphasis is given to the effects of selenium on man, conclusions are drawn from the evaluation of current knowledge on the subject, and recommendations are made for further research. Although selenium is highly toxic in many of its chemical forms, a number of factors suggests that it probably is not a significant pollution problem. The bulk of the industrial uses of selenium is such that only small amounts of the element are injected into the ecosphere. Burning of coal and oil is estimated to account for nearly 70% of the selenium emitted into the atmosphere, but dispersion of selenium as a result of fossil fuel combustion does not appear to be an important pollution problem. There is little evidence to indicate any biomagnification of selenium in the food chain. GRA

N76-31731# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
RESIDUE-REMOVAL METHODS FOR PESTICIDES AND INDUSTRIAL CHEMICALS FOUND IN AQUATIC ENVIRONMENTS
Roderick W. Young, O. D. Parr, and Jean K. Dickinson Dec. 1975 24 p refs Sponsored in part by the Interior Dept.
(PB-250747/3; W76-05249; VPI-WRRC-Bull-90; OWRT-A-057-VA(1)) Avail: NTIS HC $3.50 CSCL 07D

Various methods are evaluated that have been advanced for separation of polychlorobiphenyls from chlorinated pesticides, to see which were effective in detecting and removing these residues often present in the aquatic environment. Preliminary investigations also were made of a new approach, the silylation of carbamates. Finally, a gas chromatographic procedure for chlorophacinone (CPN) was developed by brominating the parent compound.GRA

N76-31732# Auburn Univ., Ala. Water Resources Research Inst.
NATURE AND STABILITY OF COMPLEX MERCURY COMPOUNDS IN SURFACE AND GROUND WATERS, PHASE 2 Final Technical Completion Report
James E. Land and William R. Mountcastle, Jr. Jan. 1976 60 p refs Sponsored in part by the Interior Dept.
(PB-251375/2; W76-05838; WRRI-Bull-24; OWRT-A-038-ALA(1)) Avail: NTIS HC $4.50 CSCL 07D

Attempts to determine the hydrolytic and polymeric species present at 25C in an aqueous solution of methylmercury hydroxide, with an ionic strength of 0.1 M using potassium nitrate, as a function of the hydronium ion concentration by means of electromotive force measurements and polarographic analysis are described. Three mathematical models are presented which might account for the possible equilibria involved and arguments based upon collected data are advanced to show that one of these is more likely than the other two. To ascertain if slow attainment of equilibrium between the methylmercury species was causing the electromotive force and reduction potentials to be meaningless, studies were made at a higher temperature of 35C but the results were inconclusive. GRA

N76-31733# California Polytechnic State Univ., San Luis Obispo. Dept. of Chemistry.
AN INVESTIGATION OF GAS PHASE OZONOLYSIS REACTIONS Final Report
David G. Williamson Apr. 1976 55 p refs
(PB-251671/4; EPA-6003-76/024) Avail: NTIS HC $4.50 CSCL 07C

A simple gas phase stopped-flow apparatus has been used to determine the rates and stoichiometry for the reactions of ozone with ethylene, propene, 1-butene, methylpropene, cis-2-butene, and trans-2-butene. Measurements of the intensity of light scattered by aerosols generated by the reaction of ozone with trans-2-butene and with ethylene were made as a function of reaction time and initial reactant concentration. This study could be used in the air pollution areas. GRA

N76-31734# Monsanto Research Corp., Dayton, Ohio.
PARTICULATE CONTROL MOBILE TEST UNITS: FIRST YEAR'S OPERATION
Robert E. Opferkuch Feb. 1976 73 p refs
(Contract EPA-68-02-1816)
(PB-251722/5; EPA-600/2-76-042) Avail: NTIS HC $4.50 CSCL 07A

The report summarizes the first year of operation of EPA-owned mobile test units that are being used in the field to study the applicability of different control methods to the control of fine particulate emitted from a wide variety of sources. Two mobile units are described: a fabric filter (baghouse) and a wet scrubber. The latter includes two types: venturi and sieve tray. Results from the baghouse tests on a coal-fired power plant indicate suitability of a baghouse, with woven glass bags, for control of dust from this type of source. Results from tests on a pulp mill lime recovery kiln show high dust removal efficiency; however, the associated high moisture content of the gases portends operating problems sufficient to indicate that a baghouse would be unsuitable for control of dust from this source. Operation of the mobile scrubber unit during the year was confined to startup testing and correction of mechanical and operating difficulties. GRA

N76-31735# TRW Systems Group, Redondo Beach, Calif.
ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES, ORGANIC CHEMICALS, PESTICIDES, AND EXPLOSIVES INDUSTRIES Final Report
Gerald I. Gruber Apr. 1975 377 p refs
(Contract EPA-68-01-2919)
(PB-251307/5; TRW-25666-6010-TU-00; EPA-530/SW-118C) Avail: NTIS HC $10.75 CSCL 07A

For the manufacturers of industrial organic chemicals, pesticide preparations and formulations and explosives the following were determined: (1) quantities and geographic distributions of land destined hazardous wastes, (2) present practices for treatment and disposal of land destined hazardous wastes, (3) commerical control technology to reduce the hazards presented by disposal of such wastes, and (4) the cost of present practices and the applicable commercial technology. GRA

N76-31736# Environmental Health Resource Center, Chicago, Ill.
HEALTH EFFECTS AND RECOMMENDED ALERT AND WARNING SYSTEM FOR OZONE Final Report
11 Aug. 1976 49 p refs
(PB-251112/9) Avail: NTIS HC $4.00 CSCL 06T

Ozone levels were reported to have exceeded 0.1 ppm. in Chicago on numerous occasions during the summer months of 1974. Ozone is known to cause irritation to the nose, throat, and the mucosa lining of the respiratory tract. It also contributes to decreased pulmonary efficiency and may affect other systems of the body (e.g., circualtory nervous). Because of these and other serious health effects, the Environmental Health Resource Center has recommended changes in the present ozone alert and warning system used by Chicago, Cook County, and the State of Illinois. GRA

N76-31737# Development Planning and Research Associates, Inc., Manhattan, Kans.
WATER POLLUTION CONTROL ACT OF 1972, ECONOMIC IMPACTS, DIRECT AND CUMULATIVE INDUSTRY IMPACTS Final Report
Nov. 1975 175 p
(Contract WQ5AC011)
(PB-251224/2; NCWQ-75/75) Avail: NTIS HC $6.75 CSCL 13B

Authors summarize the economic impacts of the 1977(BPT) and 1983(BAT) requirements of the 1972 Federal Water Pollution Control Act Amendments on selected food industries. Industry-wide direct and cumulative interindustry impacts were assessed. Cumulative retail price and quantity impacts for beef, poultry, pork and processed fruits and vegetables are expected to be modest. Incrementally, BPT control levels are expected to result in greater retail impacts than BAT. Retail impacts stemming from pollution control in industries which perform initial supplying and producing functions will be less severe than price impacts stemming from final processing industries. Retail price impacts on plants serviced by public waste treatment systems will be significant. Authors estimate net capital investment for pollution controls along with operating and maintenance costs. GRA

N76-31738# Midwest Research Inst., Kansas City, Mo.
STUDY ON CHEMICAL SUBSTANCES FROM INFORMATION CONCERNING THE MANUFACTURE, DISTRIBUTION, USE, DISPOSAL, ALTERNATIVES, AND MAGNITUDE OF EXPOSURE TO THE ENVIRONMENT AND MAN. TASK 3: THE MANUFACTURE AND USE OF SELECTED INORGANIC CYANIDES Final Report
Ralph R. Wilkinson and Gary R. Cooper 2 Apr. 1976 229 p refs
(Contract EPA-68-01-2687)
(PB-251820/7; EPA-560/6-76-012) Avail: NTIS HC $8.00 CSCL 07A

The purposes of the study were to identify the production methods, importation, exportation, use patterns, and exposure to man and the environment of selected inorganic cyanides, including hydrogen cyanide, from 1965 to 1975. Data for the production methods included the specific process, raw materials, annual production quantities, major manufacturers, waste products, environmental management of process wastes, and other production data. Use patterns were identified, and annual consumption data were compiled for each compound in the respective area of utilization. Major consumers in each use area were identified. Various possible methods for the exposure of man and the environment to inorganic cyanides were discussed and evaluated. Future production quantities and areas of usage were estimated to 1985. GRA

N76-31739# Versar, Inc., Springfield, Va.
DEVELOPMENT OF A STUDY PLAN FOR DEFINITION OF PCBS USAGE, WASTES, AND POTENTIAL SUBSTITUTION IN THE INVESTMENT CASTING INDUSTRY, TASK 3 Final Report
James D. Barden and Robert L. Durfee Jan. 1976 41 p refs
(Contract EPA-68-01-3259)
(PB-251842/1; EPA-560/6-76-007) Avail: NTIS HC $4.00 CSCL 07A

A study plan, designed to define the usage of polychlorinated biphenyls (PCBs) and terphenyls (PCTs) in the investment casting industry, is developed. Current knowledge was reviewed and used as input to the study plan development. Methods of information gathering and data sources, as required to define industry scope and technology, wastes, and substitution technology, were also determined. GRA

N76-31740# Science Applications, Inc., El Segundo, Calif.
HEALTH EFFECTS OF NITROGEN OXIDES Quarterly Report
R. Ziskind and D. Hausknecht Feb. 1976 47 p refs Sponsored by the Elec. Power Res. Inst.
(PB-251264/8; EPRI-571-1A) Avail: NTIS HC $4.00 CSCL 06T

The oxides of nitrogen of possible concern in air pollution are nitric oxide, nitrogen dioxide, nitrogen pentoxide, inorganic nitrates, and organic nitrates. Available data on the physiologic and toxicologic effects of gaseous nitrogen oxides show that NO2 as a freely diffusable gas has some potential of causing adverse effects on human health and well being. Some of these data are summarized for human and animal observations which have been made at varying levels under both acute and chronic exposures. Critical parameters relating to the health effects of NO2 that are discussed include: temperature, predisposing disease, heredity, age, and interactions with other environmental pollutants. GRA

N76-31741# Environmental Protection Agency, Research Triangle Park, N.C.
THE GENERAL MOTORS/ENVIRONMENT PROTECTION AGENCY SULFATE DISPERSION EXPERIMENT. SELECTED EPA RESEARCH PAPERS
R. K. Stevens, P. J. Lamothe, W. E. Wilson, and J. L. Durham Apr. 1976 152 p refs
(PB-252931/1; EPA-600/3-76-035) Avail: NTIS HC $6.75 CSCL 13B

In the fall of 1975, General Motors conducted an extensive field experiment at the GM proving grounds in Milford, Michigan. The purpose of the experiment was to measure the concentrations and assess characteristics of aerosols, especially sulfates and sulfuric acid, emitted by a fleet of catalyst-equipped cars operated under simulated freeway conditions. In addition, emission dispersion and meteorological parameters were measured; this data served as input for developing a plume dispersion model. At the invitation of General Motors, EPA, along with their contractors and grantees, participated in this experiment. This report consists of several important research papers that discuss and present the results of studies carried out by EPA during the GM experiment. GRA

N76-31742# A. P. T., Inc., San Diego, Calif.
CASCADE IMPACTOR CALIBRATION GUIDELINES Environmental Protection Technology Series
Seymour Calvert, Charles Lake, and Richard Parker Apr. 1976 45 p refs
(Contract EPA-68-02-1869)
(PB-252656/4; EPA-600/2-76-118) Avail: NTIS HC $4.00 CSCL 14B

Guidelines for routine calibrating of cascade impactors are reported. The basic calibration technique discussed involves generating uniformly sized particles, testing individual stages, determining particle number concentrations by light scattering, and calculating efficiencies for given test parameters. Each component of the technique is discussed. The results of calibrations of three cascade impactors and comparisons with published studies are presented. Author (GRA)

N76-31743# Olson Labs., Inc., Anaheim, Calif.
DEFECT TESTING OF FIVE CATALYST EQUIPPED FORD PROTOTYPE VEHICLES, VOLUME 1 Final Report
R. G. McMillen Aug. 1975 51 p
(Contract EPA-68-03-0452)
(PB-250582/4; EPA-460/3-75-008A-Vol-1) Avail: NTIS HC $4.50 CSCL 13B

The objective of the work performed under this contract was to provide test data on the performance of a known exhaust catalytic system under a variety of engine parameter conditions. The vehicles were Ford Galaxie four-door sedans equipped with 400 cubic inch V-8 engines and Englehard catalytic converter systems. Each vehicle received a 1975 FTP Emissions Test in accordance with the Federal Register for every induced defect. Volume 1 contains a description of the tests. GRA

N76-31744# Olson Labs., Inc., Anaheim, Calif.
DEFECT TESTING OF FIVE CATALYST-EQUIPPED FORD PROTOTYPE VEHICLES, VOLUME 2 Final Report
R. G. McMillen Aug. 1975 346 p
(Contract EPA-68-03-0452)
(PB-250583/2; EPA-460/3-75-008B-Vol-2) Avail: NTIS HC $10.00 CSCL 13B

The objective of the work performed under this contract was to provide test data on the performance of a known exhaust catalytic system under a variety of engine parameter conditions. Volume 2 contains technical pollutant data resulting from these tests. Portions of this document are not fully legible. GRA

N76-31745# Stanford Research Inst., Arlington, Va.
MEETING REPORT: ADVANCED FOSSIL FUELS SECTOR GROUP, RESEARCH TRIANGLE PARK, 13 NOV. 1975
Feb. 1976 46 p ref
(Contract EPA-68-01-2940)
(PB-250686/3; EPA-600/9-76-006) Avail: NTIS HC $4.00 CSCL 13B

Two general areas of concern were addressed: (1) R&D strategies for control technology and the relationships of control technology R&D to development of standards and in respect to impact on industry; (2) Pollutant prioritization and the relationship of characterization and prioritization to control technology, standards and the impact on other government agencies and industry. These areas of concern were considered in the context of current control technology versus that which may be required in the future, in particular as it relates to coal gasification and liquefaction. GRA

N76-31746# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
BACKGROUND INFORMATION FOR STANDARDS OF PERFORMANCE: PRIMARY ALUMINUM INDUSTRY.

VOLUME 3: SUPPLEMENTAL INFORMATION
Jan. 1976 52 p ref
(PB-250667/3; EPA-450/2-74-020C-Vol-3) Avail: NTIS HC $4.50 CSCL 13B

This volume is the third in a series on standards of performance for primary aluminum plants. This volume includes the proposed regulation comments and Agency responses to these comments, updated economic impact information, and a discussion of problems encountered with the analytical method for sampling emissions. GRA

N76-31747# Dynatrend, Inc., Burlington, Mass.
US DEPARTMENT OF TRANSPORTATION CIAP ATMOSPHERIC MONITORING AND EXPERIMENTS. THE PROGRAM AND RESULTS Final Report, May 1972 - Jun. 1975
Ronald J. Massa and Rudolf Penndorf Jun. 1975 415 p refs
(Contract DOT-OS-20104)
(PB-250531/1; D101-75-FR; DOT/TST-75-106) Avail: NTIS HC $11.00 CSCL 13B

This report describes the CIAP atmospheric monitoring and experiments subprogram as it was executed between 1972 and 1975. Included is a brief descriptive compendium of the stratospheric measurement instruments used and the instrument platforms deployed by the more than 60 investigators who participated in the program. The technical data obtained from these stratospheric measurements are summarized and interpreted with respect to their impact on the assessment of the effects of stratospheric pollution by high altitude jet aircraft. Conclusions drawn and recommendations for future stratospheric measurements are also included. GRA

N76-31748# Stanford Research Inst., Menlo Park, Calif.
ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADE-OFFS. VOLUME 2: RELATIVE ENVIRONMENTAL ASSESSMENT OF METHODS TO INCREASE ENERGY PRODUCTION, CRUDE OIL, PIPELINE QUALITY GAS, AND ELECTRICITY FROM WESTERN COAL Energy and Environment Series
Mark D. Levine and Robert V. Steele Oct. 1975 132 p refs
(Contract EPA-68-01-2469)
(PB-250001/5) Avail: NTIS HC $6.00; HC also available in set of 4 reports as PB-249999-SET, HC $18.00 CSCL 13B

This report concerns the development and application of a methodology for evaluating relative environmental impacts on alternative ways of producing energy. Topic areas cover the use of western coal for electricity generation, options for increasing U.S. oil production, and options for increasing pipeline quality gas supplies. GRA

N76-31749# California Univ., Berkeley. Continuing Education in City, Regional, and Environmental Planning.
PROCEEDINGS OF THE CONFERENCE ON AIR QUALITY IMPACT ANALYSIS FOR APPLICATION IN LAND USE AND TRANSPORTATION PLANNING
Elaine T. Hussey, ed., Richard H. Thuillier, and George Hagevik Sep. 1975 304 p refs Conf. held in Berkeley, Calif., 24-26 Jun. 1974
(Grant EPA-T-900345)
(PB-250560/0; EPA-450/3-76-009) Avail: NTIS HC $9.75 CSCL 13B

The conference proceedings covered the following topics: air quality and land use, air quality management and land use regulation, institutional issues in air quality management, air quality considerations and local land use planning. A needed framework for relating air quality content of EIRs to decision making, interaction of the planning and regulatory communities, general aspects of air pollution, the role of meteorology in air quality, the state of the art in air quality modeling, air pollutant emissions and emission factors, meteorological modeling input, simplified techniques for air quality impact quantification, elements of an adequate impact presentation, and a critique of sample impact reports. GRA

N76-31750# Health Effects Research Lab., Research Triangle Park, N. C.
ANNUAL CATALYST RESEARCH PROGRAM REPORT, SUMMARY Annual Program Status Report, Jan. - Sep. 1974
Sep. 1975 56 p refs
(PB-249908/5; EPA-600/3-75-010A) Avail: NTIS HC $4.50 CSCL 13B

This report constitutes the first Annual Report of the ORD Catalyst Research Program required by the Administrator as noted in his testimony before the Senate Public Works Committee on November 6, 1973. It includes all research aspects of this broad multi-disciplinary program including: emissions characterization, measurement method development, monitoring, fuels analysis, toxicology, biology, epidemiology, human studies, and unregulated emissions control options. Principal focus is upon catalyst-generated sulfuric acid and noble metal particulate emissions. GRA

N76-31751# Southwest Research Inst., San Antonio, Tex.
COLLABORATIVE STUDY OF PARTICULATE EMISSIONS MEASUREMENTS BY EPA METHODS 2, 3, AND 5 USING PAIRED PARTICULATE SAMPLING TRAINS (MUNICIPAL INCINERATORS)
Henry F. Hamil and Richard E. Thomas Mar. 1976 99 p refs
(Contract EPA-68-02-0626)
(PB-252028/6; EPA-600/4-76-014) Avail: NTIS HC $5.00 CSCL 13B

This report represents the results of statistical analyses of data from a collaborative test using paired particulate sampling trains. The purposes of the test were to estimate the minimum variability that can be expected with the use of Method 5 and to determine the effect of spatial/temporal changes in the gas flow on a Method 5 result. The paired train consists of two mirror-image Method 5 trains in a single box, and allows two independent laboratories to obtain simultaneous particulate concentration data with probe nozzles only 5.8 cm apart. The report deals with Method 5, and also Method 2 (Velocity) and Method 3 (Stack Gas Analysis), which are called for in the use of Method 5. In addition, the particulate concentrations are converted to the applicable compliance test result for the source tested, and these are also analyzed. The latest in-house revisions of the EPA methods were used in this test, and the results contained here are applicable to these revisions. GRA

N76-31752# Southeast Michigan Council of Governments, Detroit.
PROJECTION OF POTENTIAL NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS). VIOLATIONS ON THE SEMCOG 1974 HIGHWAY NETWORK Transportation Working Paper
David A. Doctor and James S. Casha Sep. 1975 26 p refs
Sponsored by Mich. Dept. of State Highways and Transportation, Lansing and FHA, Washington, D. C.
(Contract FHWA/MDSHT-74-0613)
(PB-252117/7; TRAN-WP-21-9/75) Avail: NTIS HC $4.00 CSCL 13B

The paper is intended to present the results of the 'manual model' presented in TRAN-WP-15-5/75 when run on SEMCOG's 1970 Highway Network File updated for 1974 traffic. The paper includes the variables used as input for the operation of the model. By their use a map of the highway sections and intersection in the region which, in 1974, under the limited assumptions of the model, exhibit the potential for violation of the National Ambient Air Quality Standards was constructed (map not included). The application of this model as a 'sketch-type' planning tool is being advanced for review by local, state and federal agencies. If this application is favorably received, further model runs will be made to indicate concentration changes up to and, if necessary, beyond the target year for attainment of the National Ambient Air Quality Standards. GRA

N76-31753# GCA Corp., Bedford, Mass. Technology Div.
METHODOLOGY FOR INVENTORYING HYDROCARBONS Final Report
Philip Digasbarro and Mark Bornstein Mar. 1976 98 p refs
(Contract EPA-68-02-1006)
(PB-252009/6; EPA-600/4-76-013) Avail: NTIS HC $5.00 CSCL 13B

A methodology for estimating emissions of hydrocarbons and organic compounds to the atmosphere is described, with emphasis on emission from stationary point and area sources. The

methodology is an elaboration of the National Emissions Data System (NEDS), and is based upon, but not limited to, an inventory of hydrocarbon emissions within the Boston, MA. Air Quality Control Region; emissions from motor vehicles are not considered, since thay are subjected to a different methodology. Sources of data, and procedures to obtain data are described. Data sources include trade associations, census figures, and wholesale suppliers. Examples are given of work sheets for compiling data, and of questionnaires with instructions for completion that can be sent to various types of establishments that are potential emission sources. Application of the methodology to the St. Louis Air Quality Control Region for development of a hydrocarbon emission inventory for the Regional Air Pollution Study is outlined. GRA

N76-31754# Voorhees (Alan M.) and Associates, Inc., McLean, Va. Planning Environmental International Div.
INTERIM GUIDE FOR ENVIRONMENTAL ASSESSMENT/ HUD FIELD OFFICE EDITION
Jun. 1975 463 p Sponsored by Jason M. Cortell and Assoc., Wellesley Hills, Mass. and Reg Griffith Assoc., Washington, D.C.
(Contract HUD-H-2080)
(PB-252231/6) Avail: NTIS HC $12.00 CSCL 13B

The guide covers, under eighty physical and social subcomponents, the broad range of concerns encountered in the environmental assessment of urban development projects. Technical guidance in systematic analysis and evaluation, information sources, references and procedures is offered to HUD field offices, and to local government agencies responsible for environmental review in compliance with the National Environmental Policy Act under the Community Development Block Grant Program. GRA

N76-31755# GCA Corp., Bedford, Mass. Technology Div.
PRELIMINARY EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS, VOLUME 2 Final Report, Mar. - Dec. 1975
Norman Surprenant, Robert Hall, Steven Slater, Thomas Susa, and Martin Sussman Mar. 1976 557 p refs
(Contract EPA-68-02-1316)
(PB-252175/5; GCA-TR-75-26-G-Vol-2; EPA-600/2-76-046B-Vol-2) Avail: NTIS HC $13.50 CSCL 13B

The report gives results of a preliminary emissions assessment of the air, water, and solid waste pollutants produced by conventional stationary combustion systems. It gives results in four principal categories: utilities (electric generation), industrial (steam generation, space heating, and stationary engines), commercial/institutional (space heating and stationary engines), and residential (space heating). For each principal combustion system category, it gives: process types and operating efficiencies, fuel consumption, pollutant sources and characteristics, major research and development trends, fuel consumption trends, and technical areas where emission data are incomplete or unreliable. It also gives the pollutant emissions from applicable unit operations for each of 56 source classifications, using a uniform combustion source classification system. It identifies major gaps in available data regarding the population and capacity of combustion systems, application of control measures, fuel consumption, and other parameters which significantly influence pollutant characteristics and emission rates. GRA

N76-31756# Naval Weapons Center, China Lake, Calif.
ENGINEERING STUDY OF TOXIC EXHAUSTS Final Report, Feb. 1973 - Sep. 1974
Melvin P. Nadler Feb. 1976 104 p refs
(AF Proj. 5730)
(AD-A022671; AFRPL-TR-76-13) Avail: NTIS CSCL 13/2

Some aspects of the environmental hazard of large solid rocket motors have been investigated. Adsorption experiments of HCl(g) and CO(g) onto Al2O3 were performed. The afterburning of CO to CO2 was found to be 99% complete. The ground cloud produced during a Titan launch would contain 9 ppm CO initially and 50-82 ppm CO if the total burn occurred on the pad. Hydrogen chloride and nitric oxide measurements were made in the ground clouds produced from small solid rocket motors. Experiments indicated that lower than thermodynamically predicted NO concentrations exist in the ground cloud. The HCl dosages measured show the HCl in the intial ground cloud to be approximately that predicted thermodynamically. The initial ground cloud is non-homogeneous in HCl and NO, and HCl(g) was found outside the visible cloud. Experiments were also performed comparing five different HCl detectors under field conditions. The instrument comparison showed that little HCl aerosol exists in the turbulent ground cloud for relative humidities less than 30%. Also, the HCl tied to particles is much higher than what would be predicted from laboratory experiments. GRA

N76-31757# Battelle Columbus Labs., Ohio.
MOLECULAR SIEVE NOx CONTROL PROCESS IN NITRIC ACID PLANTS Final Report, Oct. 1974 - Nov. 1975
Harvey S. Rosenberg Jan. 1976 76 p refs
(Contract EPA-68-02-1323)
(PB-250555/0; EPA-600/2-76-015) Avail: NTIS HC $5.00 CSCL 07A

The applicability of molecular sieve technology to the control of NOx emissions from nitric acid plants was investigated. Field test data from a plant using this technology show that, after 6 months of operation, the plant still controls NOx emissions to well within the New Source Performance Standard (NSPS). Field test data from a second plant, 10 months after start-up, show that NOx emissions are below the NSPS, even though the sieve was damaged. The process appears able to achieve an average effluent NOx concentration of 50 ppm, based on tests at the former plant; however, this concentration was not achieved during the tests at the latter plant. It is believed that a two year sieve life can be achieved, and it appears that molecular sieve technology is technically feasible. The capitalized cost for the molecular sieve process is higher than for catalytic reduction and lower than for extended absorption. GRA

N76-31758# Flynn and Emrich Co., Baltimore, Md.
IRON FOUNDRY CUPOLA RECUPERATIVE EMISSION CONTROL DEMONSTRATION Final Report, Jun. 1972 - Oct. 1975
James F. Turner Jan. 1976 54 p refs
(Contract EPA-68-02-0286)
(PB-250481/9; EPA-600/2-76-004) Avail: NTIS HC $4.50 CSCL 11F

The report gives results of a project intended to demonstrate the use of a dry, solid-media heat exchanger for the production of hot blast air for the cupola as an integral part of the air pollution control system. Economic advantages--in the form of reduction in fuel costs, operating costs, and air pollution control equipment costs--were expected. Data on the operation of the cupola and heat exchanger were to be analyzed with, and used to refine, a computer model. The refined model was then to have been used to extend the results to other operations. The system never became operational because of problems in interfacing the operation of the cupola, heat exchanger, and air pollution control systems. The report outlines system design deficiencies, presents the results of the work completed on the computer model, and describes the test equipment selected. GRA

N76-31759# Metro Monitoring Services, Covina, Calif.
LOS ANGELES TO VENTURA OVER WATER OZONE TRANSPORT STUDY, VOLUME 1 Final Report, Jun. - Jul. 1975
Erwin K. Kauper and Brand L. Neimann Aug. 1975 59 p refs
(Contract ARB-4-1126)
(PB-251974/2; ARB-R-4-1126-43-Vol-1) Avail: NTIS HC $4.50 CSCL 13B

Distributions of temperature and ozone aloft were determined during a ten day observational program involving an instrumented light aircraft flying between Los Angeles and Ventura County. Ozone layers were commonly detected above the base of the sub-tropical subsidence inversion. Concurrent winds aloft measurements made at intervals throughout the day and night provided data from which streamline air flow maps were prepared for heights associated with the high ozone values. From these maps, trajectories were constructed which indicated that the measured ozone aloft over coastal Ventura County came from the Los Angeles basin. GRA

N76-31760# American Water Works Association Research Foundation, Denver, Colo.
WATER POLLUTION CONTROL ACT OF 1972, COSTS AND CAPABILITIES. WATER TREATMENT SYSTEMS Final Report
Jul. 1975 67 p refs
(Contract WQ5AC094)
(PB-252039/3; NCWQ-75/103) Avail: NTIS HC $4.50 CSCL 13B

The anticipated impacts of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) on water treatment system requirements and costs are assessed. In the aggregate, the cost to the majority of water utilities that stand to benefit from the law far outweighs the gain. In the opinion of many water utility and state regulatory officials, implementation of the effluent guidelines as proposed is not cost effective in the majority of cases. Only a small percentage of water utilities that reported an improvement in water quality also reported a reduction of costs. The financial benefits expected to accrue from implementation of the act are essentially insignificant. GRA

N76-31761# GKY and Associates, Alexandria, Va.
WATER QUALITY ANALYSIS: THE POTOMAC RIVER Final Report
Jan. 1975 110 p refs
(Contract WQ5AC060)
(PB-252038/5; NCWQ-75/91) Avail: NTIS HC $5.50 CSCL 13B

A comprehensive water quality analysis at the Potomac River was undertaken as part of a national assessment of anticipated environmental impacts of theoretically achieving or not achieving the requirements and goals of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). Characterized are historical and existing water quality conditions, and resulting water quality within the site is projected, assuming specific levels of wastewater treatment to point source effluents entering the study site. This assessment is one of 41 similar studies conducted for the Environmental Sciences sector of the National Commission on Water Quality. GRA

N76-31762# Radian Corp., Austin, Tex.
ENVIRONMENTAL EFFECTS OF TRACE ELEMENTS FROM PONDED ASH AND SCRUBBER SLUDGE Final Report
W. F. Holland, K. A. Wilde, J. L. Parr, P. S. Lowell, and R. F. Pohler Sep. 1975 403 p refs Sponsored by the Elec. Power Res. Inst.
(PB-252090/6; EPRI-202) Avail: NTIS HC $11.00 CSCL 13B

The disposal of solid wastes from coal fired electric generating stations was investigated from the standpoint of trace element contamination of ground waters. Actual samples of ash and sludge from five operating generating stations were exposed to leaching conditions to simulate ponding. The levels of the dissolved trace elements were in general low, near the analytical detection limit. Selenium, chromium, boron, and in isolated instances, mercury and barium exceeded the proposed EPA public water supply guidelines. Passage of pond effluent through soil was found to provide significant protection against ground water contamination by trace elements. GRA

N76-31763# Utah Univ., Salt Lake City.
PROCEEDINGS OF THE INTERAGENCY SYMPOSIUM ON UNIVERSITY RESEARCH IN TRANSPORTATION NOISE (3RD) Final Report
14 Nov. 1975 648 p refs Symp. held at Salt Lake City, 12-14 Nov. 1975 Sponsored in part by DOD, EPA and NSF
(Contract DOT-OS-50480)
(PB-252075/7; DOT/TST-76-58) Avail: NTIS HC $16.25 CSCL 13B

The Symposium dealt with research in basic and applied noise problems related to transportation. Papers presented cover surface transportation noise generation, noise propagation and transmission, community reaction, combustion noise, aerodynamic noise, turbulence, rotor noise, jet noise, and duct acoustics. GRA

N76-31764# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
MONITORING AND AIR QUALITY TRENDS REPORT, 1974 Annual Report
Feb. 1976 386 p refs
(PB-252269/6; EPA-450/1-76-001) Avail: NTIS HC $10.75 CSCL 13B

The report presents a comprehensive tabulation of the nation's (U.S.A.) air quality and monitoring activities for 1974. These summaries are based on data acquired through extensive monitoring activities conducted by Federal, state and local air pollution control agencies, and compiled according to the nation's 247 Air Quality Control Regions. Information is provided on the five pollutants for which National Ambient Air Quality Standards have been set (suspended particulate matter, sulfur dioxide, carbon monoxide, oxidants, and nitrogen dioxide). Analyses of pollutant trends are presented for the period 1970-1974, plus a discussion of nonurban ozone and estimates of nationwide emissions for the period 1970-1974. GRA

N76-31765# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
A METHOD FOR MONITORING EUTROPHICATION IN RIVERS Completion Report
Mahlon G. Kelly, George M. Hornberger, and Bernard J. Cosby Dec. 1975 229 p refs
(Contract DI-14-31-0001-4231)
(PB-252058/3; W76-06803; OWRT-C-5333(4231)(1)) Avail: NTIS HC $8.00 CSCL 13B

A method for automated in situ measurement of net community productivity was developed. The report describes (1) the method as it may be routinely used as a monitoring technique with completely automated data processing and the new measurement and recording system which was developed to implement the technique, (2) the applicability of the method in eutrophication evaluation in a variety of environments, and (3) a routine procedure for implementation of the method by other potential users. The utility of the technique was demonstrated. Measurements of dissolved oxygen, temperature and solar radiation were used to estimate net community production (P-R), respiration (R), gross production (P), production efficiency and the P:R ratio for six rivers during the summer of 1974. Analysis of these data and comparison with a subjective ranking of the 'eutrophy' of the rivers based on nutrient and chlorophyli data showed that productivity measurements in streams can be used to evaluate eutrophication potential. GRA

N76-31766# IR and T, Arlington, Va.
STRATEGIC ENVIRONMENTAL ASSESSMENT SYSTEM RESIDUALS FORECASTING. AN ANALYSIS OF RESULTS Final Report
Feb. 1976 64 p refs
(Contract WQ5AC018)
(PB-252041/9) Avail: NTIS HC $4.50 CSCL 13B

The Strategic Environmental Assessment System (SEAS) developed by the U.S. Environmental Protection Agency is used to assess the impacts of the recommended control strategies of the Federal Water Pollution Control Act Amendments of 1972 on the generation and the discharge of industrial residuals. A set of water residual coefficients and economic growth projections for 350 significant industrial point source categories were entered into SEAS. Authors consider to what extent the disaggregation of sectors and the incorporation of technological information has improved the ability of SEAS to forecast residual discharge levels, along with its implications for national environmental policy. Also considered is the predictive value of the model and a discussion of what improvements are needed to make SEAS a more fully analytical tool. (GRA)

N76-31767# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
REGIONAL AIR POLLUTION STUDY: EXPEDITIONARY RESEARCH PROGRAM, SUMMER 1975 Final Report
William C. Zegel Feb. 1976 110 p Prepared by Ryckman, Edgerley, Tomlinson, and Associates, Inc.
(Contract EPA-68-02-1081)
(PB-252035/1; EPA-600/3-76-016) Avail: NTIS HC $5.50 CSCL 13B

Local and regional scale air quality simulation models are

studied by the Regional Air Pollution Study (RAPS). Inherent in this effort is the creation of a comprehensive, accurate, and readily-retrievable data base containing emission rates, concentrations of atmospheric pollutants, and pertinent meteorological measurements. An integrated program was prepared for the conduct of the RAPS which includes data collection on both a routine and an expeditionary basis. The Summer 1975 RAPS Expeditionary Research Program which was designed to procure detailed atmospheric observations to better understand selected pollutant and atmospheric phenomena is described. Data collection activities are described in each of four areas: (1) pollutant transport and dispersion; (2) pollutant transformation and removal; (3) pollutant measurement program; and (4) pollutant effects studies. GRA

N76-31768# Aerospace Corp., El Segundo, Calif.
EVALUATION OF INTERFACE BETWEEN VEHICLE FUEL FILLPIPES AND VAPOR RECOVERY NOZZLES Final Report
Warner B. Lee Oct. 1975 163 p
(Contract EPA-68-01-0417)
(PB-251975/9; ATR-76(7354)-1; EPA-460/3-75-010) Avail: NTIS HC $6.75 CSCL 13B

Control devices at gasoline service stations are discussed. Field tests were made of the fit of three prototype vapor recovery nozzles on 860 in-use vehicles in support of EPA activities relating to the recovery of gasoline vapor presently lost to the atmosphere during the vehicle fueling process. The nozzle fit observations were assigned numerical ratings in accordance with a fit code logic sequence, and these results are analyzed by a procedure which quantified the nozzle fit characteristics of the in-use vehicle population for the past 15 years. Vehicles that present problems in effecting vapor recovery are specified as to type and number and the nature of the problem in each case. GRA

N76-31769# Aerospace Corp., Los Angeles, Calif. Environmental and Energy Conservation Div.
DISPOSAL OF FLUE GAS CLEANING WASTES: EPA SHAWNEE FIELD EVALUATION, INITIAL REPORT
R. B. Fling, W. M. Graven, F. D. Hess, P. P. Leo, and R. C. Rossi Mar. 1976 219 p refs
(Contract EPA-68-02-1010)
(PB-251876/9; ATR-76(7297)-1; EPA-600/2-76-070) Avail: NTIS HC $7.75 CSCL 13B

The report describes progress made during the initial phase of a field evaluation program, conducted by EPA, to assess techniques for the disposal of power plant flue gas desulfurization (FGD) wastes. The site chosen for the evaluation was TVA's Shawnee Power Station, Paducah, Kentucky. Two 10-MW prototype flue gas scrubber systems--one using lime, the other limestone--produced wastes that were stored in five disposal ponds on the plant site. Two of the ponds contain untreated waste; each remaining pond contains waste chemically treated by one of three commercial contractors. Test samples of treated and untreated wastes, ground water, surface water, leachate, and soil cores are being analyzed in order to evaluate the environmental acceptability of current disposal technology. Based on this program, engineering estimates of total costs (capital and operating) for FGD waste treatment and disposal have been made. GRA

N76-31770# Syracuse Univ. Research Corp., N.Y. Center for Chemical Hazard Assessment.
INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: KETONIC SOLVENTS Final Report
Sheldon S. Lande, Patrick R. Durkin, Deborah H. Christopher, Philip H. Howard, and Jitendra Saxena May 1976 349 p refs
(Contract EPA-68-01-3100)
(PB-252970/9; TR-76-500; EPA-560/2-76-003) Avail: NTIS HC $10.00 CSCL 06F

This report reviews the potential environmental hazard from the commercial use of ketonic solvents with the exception of acetone. Three ketones - cyclohexanone, methyl ethyl ketone, and methyl isobutyl ketone - dominate the market. Other commercial ketonic solvents include diacetone alcohol, isophorone, mesityl oxide, and acetophenone. Information on physical and chemical properties, production methods and quantities, commercial uses and factors affecting environmental contamination, as well as information related to health and biological effects, is reviewed. GRA

N76-31771# Midwest Research Inst., Kansas City, Mo.
SAMPLING AND ANALYSIS OF SELECTED TOXIC SUBSTANCES. TASK 3: VINYL CHLORIDE, SECONDARY-SOURCES Final Report, 1 Nov. - 31 Dec. 1975
John E. Going Apr. 1976 30 p refs
(Contract EPA-68-01-2646)
(PB-252966/7; EPA-560/6-76-002) Avail: NTIS HC $4.00 CSCL 06T

A sampling and analysis program was conducted to determine whether and to what extent vinyl chloride was present in ambient air due to the presence of polyvinyl chloride products. Sampling environments represent nonwork situations where a significant exposure to polyvinyl chloride products might occur. A sampling and analysis protocol was developed with a recovery efficiency of greater than 90 percent and a detection limit of 10 ppb (v/v). The interior ambient air was sampled from new and used domestic automobiles, foreign automobiles and domestic mobile homes. No evidence of vinyl chloride was found. The following commercial vinyl products, when sampled in their normal environmemt, did not produce a measurable quantity of vinyl chloride in the ambient air: vinyl wall covering; vinyl swimming pool liners; and vinyl nursery products. A room being painted with a heavily pigmented red paint was found to contain a very low level of vinyl chloride. GRA

N76-31772# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Medical and Biologic Effects of Environmental Pollutants.
CHLORINE AND HYDROGEN CHLORIDE Final Report
Apr. 1976 397 p
(Contract EPA-68-02-1226)
(PB-253196/0; EPA-600/1-76-020) Avail: NTIS HC $10.75 CSCL 07A

The purpose of this report is to discuss the medical, biologic, and environmental effects of chlorine pollution in the lower atmosphere. The first three chapters discuss the natural and anthropogenic sources of pollution by chlorine and hydrogen chloride, the varied industrial and other usages of chlorine and hydrogen chloride and the quantities consumed, the atmospheric chemistry of their transformation and transport processes, and their spatial distribution. Later chapters deal with the effects of chlorine and hydrogen chloride on man, animals, vegetation, and materials. Chapters 9 and 10 present the summary and conclusions and offer recommendations for consideration in future studies. Methods of monitoring and analyzing aqueous, gaseous, and biologic samples for chlorine and hydrogen chloride are discussed in the Appendix. GRA

N76-31773# Mee Industries, Inc., Rosemead, Calif.
RESEARCH AND DEVELOPMENT OF AN AIRBORNE HYGROSCOPIC SPRAY SYSTEM Final Report
Thomas R. Mee Apr. 1976 59 p
(Contract DI-14-06-D-7634)
(REC-ERC-76-1) Avail: NTIS HC $4.50 CSCL 07A

Three different atomization techniques: direct pressure nozzles, air jet nozzles and spinning cylinder devices, were investigated to determine which would be most suitable for development into an airborne hygroscopic spray system used in cloud seeding. The system was to be capable of producing controlled droplet spectrums ranging from 20 micrometer MMD to 200 micrometer MMD, of an ammonium nitrate-urea solution to be used as a hygroscopic seeding material. The system was to be capable of atomizing the solution at rates of 2 liters per second. Tests were conducted under static no wind conditions and in a 110 m/s air stream. The atomization device that proved most suitable was a direct pressure impaction type nozzle. A prototype airborne spray system has been designed using this type of nozzle. GRA

N76-31774# Tennessee Univ., Knoxville. Dept. of Civil Engineering.
AIR MONITORING PROGRAM TO DETERMINE THE IMPACT OF HIGHWAYS ON AMBIENT AIR QUALITY Final Report, Apr. 1973 - Jul. 1975

Kenneth E. Noll, Terry L. Miller, Robert H. Rainey, and Robert C. May 1 Jul. 1975 233 p refs Sponsored by Tenn. State Dept. of Transportation
(PB-253046/7) Avail: NTIS HC $8.00 CSCL 13B

Air pollutant concentrations measured near highways are compared to concentrations predicted by highway atmospheric dispersion models. Measurement of air pollution, meteorological conditions, traffic conditions, and topographic dimensions were all collected synchronously for use in model comparisons. The models tested include the EPA HIWAY model, the California line source model, and SRI's street canyon submodel. Also an empirical model was developed which predicts downwind dispersion due to the turbulent wake induced by moving vehicles and the time traveled by the wake as it is transported away from the highway by the wind. GRA

N76-31775# TRW Environmental Services, Redondo Beach, Calif.
THE IMPACT OF INCREASED ELECTRIFICATION ON AIR QUALITY FOR THREE SELECTED REGIONS Final Report
H. S. Goodman, J. R. Avery, and J. L. Midler Jan. 1976 114 p refs
(Contract EPA-68-02-1905)
(PB-253049/1) Avail: NTIS HC $5.50 CSCL 13B

Existing models and data bases for three candidate regions Los Angeles, Denver and St. Louis, are examined. Forecasts of regional energy supply and demand were developed in order to estimate the potential for greater electrical end use substitution. The analysis predicted the changes in emission and air quality distributions as a result of various degrees of electric energy usage and alternative fuel mixes. GRA

N76-31776# DeLeuw, Cather and Co., Washington, D.C.
CASE STUDIES OF TRANSIT ENERGY AND AIR POLLUTION IMPACTS Final Report
James P. Curry May 1976 198 p refs
(Contract EPA-68-01-2475)
(PB-253211/7; EPA-600/5-76-003) Avail: NTIS HC $7.50 CSCL 13B

The energy consumption and air pollution impacts of eight case studies of new or improvement transit services are summarized. The case studies include (1) areawide bus service improvement programs involving route extensions, increased frequencies, new lines, demand responsive service, and fare reductions; (2) new corridor exclusive busway service on the Shirley Highway and San Bernardino Freeway; and (3) new rail transit service in the Philadelphia Lindenwold corridor. Probabilistic models were developed for each of these three service improvement scenerios to account for key travel demand and transportation system factors affecting energy consumption and air pollution impact levels. Results show that low patronage response to area wide bus improvements as well as diversion from prior bus service, carpools, etc. and extensive auto access (park-and-ride, kiss-and-ride) to corridor systems reduce expected energy and air pollution gains and may, under certain conditions in four case studies, result in possible energy use increases. Additionally, it was found that auto use for corridor system access may worsen air quality conditions in suburban areas in the vicinity of corridor transit terminal locations. GRA

N76-31777# Abt Associates, Inc., Cambridge, Mass.
AN ECONOMIC ANALYSIS OF THE ENVIRONMENTAL IMPACT OF HIGHWAY DEICING Final Report, Aug. 1974 - Jul. 1975
Donald M. Murray and Ulrich C. W. Ernst May 1976 138 p refs
(Contract EPA-68-03-0442)
(PB-253268/7; EPA-600/2-76-105) Avail: NTIS HC $6.00 CSCL 13B

The cost of damages that result from the use of salt (sodium chloride and calcium chloride) on highways to melt snow and ice is assessed. A large literature search and several surveys were carried out in order to determine the types and extent of damages that have occured. An in-depth analysis was performed on all of the data obtained. The major cost sectors examined were: water supplies and health vegetation, highway structures, vehicles, and utilities. For each of the sectors a cost estimate was developed. The total annual national cost of salt related damage approaches $3 billion dollars or about 15 times the annual national cost for salt purchase and application. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-31778 Washington Univ., Seattle.
MEAN REYNOLDS STRESS MODELING OF THE ATMOSPHERIC BOUNDARY LAYER Ph.D. Thesis
Ananthanarayanan Sundarajan 1975 164 p
Avail: Univ. Microfilms Order No. 76-17651

A numerical model of the atmospheric boundary layer for the neutral and convective cases is developed based on a closure scheme. The constants for the closure are determined, whenever possible, from the excellent Kansas (1968) surface layer data. Dissert. Abstr.

N76-31779 New York Univ., N.Y.
SPECTRAL ANALYSES OF HIGH FREQUENCY GRAVITY WAVES GENERATED BY A HURRICANE Ph.D. Thesis
Robert Allen Stacy 1974 72 p
Avail: Univ. Microfilms Order No. 76-19610

Analyses of spectra from time histories taken in hurricane winds in the Gulf of Mexico place in serious doubt the existence of Phillips' (1958) f to the -5 power equilibrium range in the band .25 through .5 hz. The Pierson-Moskowitz spectrum is exceeded in this band by a factor of four or five for the highest winds in the data set. The friction velocity is about 25-325 cm/sec. Within the band studied, the spectrum is dependent on (u sub *) to the 1.5 power at low winds and (u sub *) to the 0.5 power at high winds. Within the confines of the data, an f to the -6 power, not an f to the -5 power, power law is exhibited; there is some indication of a decrease in the -6 with increasing wind. An analytic wind-dependent spectrum for the range is presented. Dissert. Abstr.

N76-31780 California Univ., San Diego.
EVOLUTION OF OCEANIC CRUST Ph.D. Thesis
Bruce Ray Rosendahl 1976 153 p
Avail: Univ. Microfilms Order No. 76-20332

Most of the East Pacific Rise crest is characterized by a 10 to 20 km wide axial block that stands several hundred meters above the regional water depth. A seismic refraction study of the flank of the East Pacific Rise shows that there are no significant changes in the structure of the crust and upper mantle along the 1.4 m.y. and 2.4 m.y. isochrons. Moreover, there is very little chronologic change in structure between the base of the axial block and the 2.4 m.y. isochron profile. It is concluded that first order variations in crustal structure are restricted to the axial block province and that the process of crustal generation in the study region has remained spatially and temporally stable for at least the last several million years. Dissert. Abstr.

N76-31781*# Kanner (Leo) Associates, Redwood City, Calif.
ORIGIN OF THE EARTH AND PLANETS (EXPLANATORY TEXT TO SERIES OF SLIDES)
A. N. Simonenko Washington NASA Jul. 1976 60 p refs Transl. into ENGLISH of the book "Proiskhozhdeniye Zemli i Planet (Poyasnitelnyy Tekst k Serii Diapositivov)" Moscow, Znaniye Press, 1972 p 1-48
(NASA-TT-F-17110) Avail: NTIS HC $4.50 CSCL 08E

The Milky Way Galaxy, ancient and modern cosmogonies, and formation of the earth and planets are discussed. Formation of the protoplanetary cloud, its composition and temperature, accretion of the planets, their rotations and comparative dimensions are included. Asteroids and comets and their possible collisions with the earth, the propagation of seismic waves, and determination of the structure, density, thermal history and differentiation of matter of the earth are discussed. The structures of other planets and of ground and satellite based exploration of the moon and Mars, and of future prospects, are also considered. Author

N76-31782*# Kanner (Leo) Associates, Redwood City, Calif.
TWILIGHT MEASUREMENTS OF THE OZONE HEIGHT DISTRIBUTION IN THE MESOSPHERE
G. G. Mikirtumova and G. V. Rozenberg Washington NASA Aug. 1976 15 p refs Transl. into ENGLISH from Byull. Abastumansk. Astrofiz. Observ. (USSR), no. 46, 1975 p 225-234
(Contract NASw-2790)
(NASA-TT-F-17202) Avail: NTIS HC $3.50 CSCL 04A

Measurements of ozone concentration above 40 km are reviewed, and a method is described by which the vertical variation in the mesopheric ozone concentration can be determined from spectrographic observations of twilight sky brightness. Spectrographic data on the vertical variation of the twilight mesospheric ozone concentration are presented which were obtained simultaneously at wavelengths of 0.59 and 0.61 micron. The good agreement of these data with previous twilight, morning, and evening measurements was taken as proof of the short duration of the ozone-forming process at heights above 30 to 40 km. It was concluded that the twilight mesospheric ozone concentration experiences almost no change at heights between 50 and 90 km, and that the measurements confirm, at least qualitatively, the predictions of the photochemical theory of equilibrium between ozone and atomic oxygen in the mesosphere. Author

N76-31783*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASUREMENTS OF THE STOCHASTIC NATURE OF ATMOSPHERIC SPECTRAL AMPLITUDES
William C. Cliff, George H. Fichtl, Margaret Alexander, and Salvador Arias Aug. 1976 33 p refs
(NASA-TM-X-73329) Avail: NTIS HC $4.00 CSCL 04A

The stochastic nature of the power spectral amplitudes of the neutral atmospheric boundary layer is examined. Probability density distributions and probability distributions of longitudinal and lateral power spectra amplitudes are computed from neutral atmospheric boundary layers. The statistical distributions are computed for frequencies of 0.006, 0.01, 0.03, 0.06, 0.1, and 0.5 Hz at each of the elevations of 18, 30, 60, 90, 120, and 150 m. When the probability density distributions are properly nondimensionalized, the data tend to collapse to a universal curve. An empirical curve fit to the universal nondimensionalized probability density distribution is also given. Probability distributions of individual frequency power spectral amplitudes are also presented for all elevations and frequencies. An interesting observation from the data is that greater than 10 percent of the time the power spectral amplitude at a given frequency will genrally be more than three times the temporal mean value computed by standard Fourier techniques. The standard power spectral density curves are also included in the report. Author

N76-31784*# Maryland Univ., College Park. Dept. of Electrical Engineering.
EFFICIENT DETECTION, ANALYSIS AND CLASSIFICATION OF LIGHTNING RADIATION FIELDS
R. O. Harger and S. A. Tretter 23 Aug. 1976, 136 p refs
(Grant NsG-5048)
(NASA-CR-148805) Avail: NTIS HC $6.00 CSCL 04A

Modeling the large scale lightning flash structure is considered. Large scale flash data has been measured from strip charts of storms of August 5, August 26, and September 12, 1975. The data is being processed by a computer program called SASEV to estimate the large scale flash statistics. The program, experimental results, and conclusions for the large scale flash structure are described. The progress made in examining the internal flash structure consists mainly of developing the software required to process the NASA digital tape data. A FORTRAN program has been written for the statistical analysis of series of events. The statistics computed and tests performed are found to be particularly useful in the analysis of lightning data. S.M.

N76-31785# Ecole Polytechnique Federale de Lausanne (Switzerland).
PARAMETRIC EXCITATION OF KINETIC ALFVEN WAVES BY WHISTLER WAVES
Liu Chen (Princeton Univ., N. Jersey) Jul. 1976 13 p refs
(LRP-108/76) Avail: NTIS HC $3.50

It is shown that a whistler wave can parametrically decay into an another whistler wave plus a kinetic Alfven wave. The parametric coupling occurs due to the electrostatic properties of the kinetic Alfven wave. Corresponding growth rate and threshold condition are obtained. Author

N76-31786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ACCURACY OF GODDARD EARTH MODELS
C. A. Wagner Jun. 1976 234 p refs Submitted for publication
(NASA-TM-X-71183; X-921-76-187) Avail: NTIS CSCL 08E

Extensive tests of Goddard geopotential models have been made with observations not used in the solutions. These tests show the accuracy of the satellite derived model (GEM 7, with 400 coefficients) to be about 4.3 m (rms) with respect to the computation of the global geoid surface. The formal precision of this solution is 0.7 m. The corresponding accuracy of the combined satellite surface gravimetry model (GEM 8, with 706 coefficients) is found to be 3.9 m (rms). Independent observations used in this assessment include: 125 lumped coefficients from 35 resonant orbits of 1 and 9 through 15 revolutions per day, two sets of (8,8) fields derived from optical-only and laser-only data, sets of zonal and resonant coefficients derived from largely independent sources and geoid undulations measured by satellite altimetry. In addition, the accuracy of GEM 7 has been judged by the gravimetry in GEM 8. The ratio of estimated to formal error in GEM 7 and 8 ranges from 2 to 5. Author

N76-31787# Royal Netherlands Meteorological Inst., De Bilt.
ON EARTHQUAKE RISK FOR NUCLEAR POWER PLANTS
A. R. Ritsema, ed. Jan. 1976 188 p refs Partly in FRENCH; partly in ENGLISH Proc. of the European Seismological Comm. Symp., Luxemburg, 20-22 Oct. 1975
(KNMI-153) Avail: NTIS HC $7.50; Roy. Neth. Meteorol. Inst., Dfl. 10

Selected papers in the field of earthquake risk for nuclear power plants in France, Denmark, the U.K., Western Germany, Switzerland, Belgium, Austria, Fennoscandia, Turkey, Spain, Portugal, Israel, and other countries are listed as well as methods for assessing and determining safe shutdown earthquake, soil-structure interactions, etc. For individual titles, see N76-31788 through N76-31808.

N76-31788 Institut de Physique du Globe, Strasbourg (France).
SEISMIC HISTORY AND MAXIMAL MAGNITUDE TO BE FORESEEN AT A GIVEN SITE [LES RECHERCHES DE SEISMICITE HISTORIQUE ET LA MAGNITUDE MAXIMALE A ENVISAGER EN UN SITE DONNE]
J. P. Rothe *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 7-11 refs In FRENCH (For availability see N76-31787 22-46)

Research work on seismic risk in France is reviewed. The problem of maximal magnitude of seismic risk foreseen at a given site is presented. The discrepancy between the historical data and the high magnitude seism appearing period obtained from the extrapolation of frequency/magnitude graphs is laid out. It is shown that it is possible to define the historical maxima intensities characterizing seismotectonic regions of limited area and, therefore, to use these data in planning nuclear power plant sites in France. Author (ESA)

N76-31789 Geodetic Inst., Charlottenlund (Denmark).
ON EARTHQUAKE RISK FOR NUCLEAR POWER PLANTS IN A NON-SEISMIC REGION
J. Hjelme *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 13-18 refs (For availability see N76-31787 22-46)

Reports on earthquakes felt in Denmark were analyzed. In several cases the epicenter is located elsewhere. In some cases no location could be established, but no epicenter is definitely located here. This makes the definition of design earthquake less suitable for studies on earthquake effects. Use of calculated risk is demonstrated, and the different steps in the procedure are discussed. Author (ESA)

N76-31790 Royal Norwegian Council for Scientific and Industrial Research, Kjeller.

THE SEISMICITY OF FENNOSCANDIA

H. Bungum and E. S. Husebye *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 19-25 refs (For availability see N76-31787 22-46)

The systematic collection of macroseismic data on earthquake occurrence in Fennoscandia began in the 1880's. Prior to that time the macroseismic information is fragmentary and incomplete, although the essential data have been preserved at least for the largest earthquakes. Using the available macroseismic and seismograph data the macroseismicity for Fennoscandia covering the time interval 1497 to 1973 was investigated. The earthquake activity was subdivided in four zones: Telemark-Vaenern, Western Norway, Lappland, and Bothnian, which account for the most of the reported seismic activity. There is some correlation between geological and geophysical information pertinent to the area and earthquake occurrence. The seismic activity of Fennoscandia is discussed in the framework of intraplate tectonics and the driving forces connected with the opening of the North Atlantic Ocean.
Author (ESA)

N76-31791 Hagfors Observatory (Sweden).

PROBABILITY MODEL FOR PEAK GROUND ACCELERATIONS IN SWEDEN

R. Slunga *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 27-34 refs (For availability see N76-31787 22-46)

From the statistical distribution of the earthquakes, estimated from observations, and from a relation between peak ground acceleration, earthquake magnitude and distance between site and hypocenter, the probabilities of exceeding given accelerations at the site can be computed. A conservative method of estimating the earthquake distribution around the site is discussed. The method is used to estimate the probable ground accelerations in the three biggest cities: Stockholm, Gothenburg, and Malmoe. Computations show that the rare earthquakes having M greater than 6 are the major contributors to the seismic risk.
Author (ESA)

N76-31792 Institute of Geological Sciences, Edinburgh (Scotland).

THE UK APPROACH TO HAZARD ASSESSMENT

P. L. Willmore and P. W. Burton *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 35-37 refs Sponsored by UK Nat. Environ. Res. Council (For availability see N76-31787 22-46)

This approach takes into account the limitation of total magnitude range for U.K. events, as revealed by Gumbel's Third Distribution, and derives an estimate of the combination of magnitude and distance most likely to produce any given value of intensity. It thereby avoids some of the problems of defining real hazards in terms of historical intensity and of extrapolation to very long return periods. Author (ESA)

N76-31793 Cologne Univ. (West Germany). Erdbebenstation Bensberg.

FIRST DRAFT OF AN EARTHQUAKE ZONING MAP OF NORTHWEST-GERMANY, BELGIUM, LUXEMBURG AND THE NETHERLANDS

L. Ahorner, J. A. Flick (Lab. Souterrain de Geodyn., Luxemburg), J. M. VanGils (Obs. Roy., Uccle, Belg.), G. Houtgast (Roy. Neth. Meteorol. Inst., De Bilt), and A. R. Ritsema *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 39-41 refs (For availability see N76-31787 22-46)

International cooperation in planning the earthquake map of northern Germany, Belgium, Luxemburg, and the Netherlands is emphasized. ESA

N76-31794 Eidgenoessiche Technische Hochschule, Zurich (Switzerland). Schweizerischer Erdbebendienst.

SEISMIC RISK MAPS OF SWITZERLAND: DESCRIPTION OF THE PROBABILISTIC METHOD AND DISCUSSION OF SOME INPUT PARAMETERS

D. Mayer-Rosa and H. A. Merz (Basler u. Hofmann) *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 45-51 refs (For availability see N76-31787 22-46)

The probabilistic model used in a seismic risk mapping project is presented. Some of its advantages and limitations are spelled out. In addition, some earthquake parameters which should be carefully investigated before using them in a seismic risk analysis are discussed. Author (ESA)

N76-31795 Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).

ON THE PRINCIPLES OF THE DETERMINATION OF THE SAFE SHUT-DOWN EARTHQUAKE FOR NUCLEAR POWER PLANTS IN AUSTRIA

J. Drimmel *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 53-56 refs (For availability see N76-31787 22-46)

At present no legal guiding lines exist in Austria for the determination of the safe shut-down earthquake. According to experience the present requirements on the site of a nuclear power plant are the following: it must be free of marked tectonic faults and it must never have been situated within the epicentral region of a strong earthquake. The maximum earthquake to be expected and the safe shut-down earthquake, respectively, are fixed by the aid of a map of frequency of strong earthquakes and a map of extreme earthquake intensities in Austria, based on macroseismic data since 1201. The corresponding values of acceleration will be prescribed according to the state of science but must at least be 0.10 g for the horizontal and 0.05 g for the vertical component of acceleration at the basement.
Author (ESA)

N76-31796 Stuttgart Univ. (West Germany). Inst. of Geophysics.

RISK ANALYSIS AGAINST EARTHQUAKE DAMAGE ON A SEISMOTECTONIC BASIS

G. Schneider *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 57-63 refs (For availability see N76-31787 22-46)

Engineering calculations against future probable earthquake hazards have to be based on a sufficiently large number of seismic spectra or time functions. The probable variations of the used functions in the frequency or in the time domain should be estimated according to the seismicity and the seismotectonic situation of the area under study. First, the interval between the smallest event with technical relevance and the largest thinkable earthquake of the studied unit has to be estimated. In a second step a certain number of variations have to be chosen regarding fracture velocity and stress drop as function in time and space distributed over the focal area. Limits are given by the time intervals between origin and stop time of the focal process.
Author (ESA)

N76-31797 Bologna Univ. (Italy). Inst. of Geophysics.

MECHANICAL MODELS OF EARTHQUAKES AND THEIR STATISTICS

M. Caputo *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 65-78 refs (For availability see N76-31787 22-46)

Various models for the statistical distribution of earthquakes are discussed. They include models in one-dimensional and two-dimensional phase space. From observed data, it was found that for each magnitude (M) range and for a sufficiently long given time interval, the total area of the faults interested in the earthquakes is nearly independent of M. Using the models, the density function of the number of earthquakes as function of the magnitude and the density function of the number of faults which caused the earthquakes of a given area as function of the area and direction of the faults were determined. It was also found, that the log n(M) (n(M) number of earthquakes per unit area and time in the range M, M + delta M) is a linear function for magnitudes M less than M sub 0 (where M sub 0 is a critical magnitude which can be determined both experimentally and theoretically) and is concave upwards for M greater than M sub 0, with a finite asymptotic value for d log n(M) greater than dn. The theory is checked in general for the seismic zones of the Mediterranean area, Europe, the Middle East and in more detail for the Appennines; in this case the distribution function of the faults of this area as function of the area and the value of M sub 0 are tentatively estimated. Author (ESA)

N76-31798 Internacional de Ingeniera Civil y Estudios Tecnicos S.A., Madrid (Spain).

DETERMINISTIC AND PROBABILISTIC APPROACH TO

DETERMINE SEISMIC RISK OF NUCLEAR POWER PLANTS: A PRACTICAL EXAMPLE

A. SorianoPena, A. LopezArroyo (Inst. Geograf. y Catastral), and J. M. Roesset (MIT) *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 79-87 refs (For availability see N76-31787 22-46)

A comparison of approaches to determine the seismic risk of a particular proposed plant site in the south of Spain near the coast of the Golfo de Cadiz was carried out. Results obtained by both methods when varying the input data are presented, including some conclusions drawn in relation to the applicability of the methods, their reliability, and their sensitivity to such change. It is concluded that the probabilistic approach is a better way to handle the uncertainties involved in the determination of the seismic risk. Author (ESA)

N76-31799 Middle East Technical Univ., Ankara (Turkey).

SEISMIC RISK DETERMINATION INCLUDING LOCAL SOIL CONDITIONS FOR TWO POSSIBLE NUCLEAR POWER PLANT SITES IN TURKEY

A. Guerpinar and P. Guelkan *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 89-96 refs (For availability see N76-31787 22-46)

A global seismic risk evaluation and geodynamical study were carried out for two potential sites in northwestern Turkey under consideration for the construction of nuclear power plants, in terms of possible and expected future ground motion. It was determined that in terms of acceleration on firm soil, site A has a greater seismic risk than site B; however, when local geological formations were introduced into the study, it was found that site B amplifies oncoming ground motion to a greater degree than site A. In conclusion, the importance of incorporating local soil conditions in seismic risk calculations is pointed out. Author (ESA)

N76-31800 United Nations Educational, Scientific and Cultural Organization, Paris (France).

UNESCO PROGRAMS IN SEISMOLOGY

In Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 99-101 Repr. from Nat. and Resources (Paris), v. 11, no. 3, 1975 p 13-15 (For availability see N76-31787 22-46)

The UNESCO programs aimed at improving knowledge of natural hazards and relative means of protection and focused on seismic zoning and the estimation in statistical terms of the risks to life and property within these zones are discussed. The development of improved monitoring systems and methods of forecasting seismic activity and the refinement and wider applications of earthquake-resistant design and construction are described briefly. ESA

N76-31801 United Nations Educational, Scientific and Cultural Organization, Paris (France). Div. of Earth Sciences.

SELECT BIBLIOGRAPHY OF UNESCO PUBLICATIONS, REPORTS AND DOCUMENTS RELATING TO SEISMICITY

E. M. FournierdAlbe *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 102-103 refs (For availability see N76-31787 22-46)

Bibliographies of reports and documents related to seismology, earthquake reconnaissance missions, earthquake study missions, etc., are presented. ESA

N76-31802 Dames and Moore, London (England).

PROBLEMS IN EVALUATING LOW PROBABILITY GROUND MOTION

Dimitri J. Papastamatiou *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 105-112 refs (For availability see N76-31787 22-46)

Current approaches in evaluating low probability seismic risk follow either of two general methods, i.e. probabilistic or limiting seismic risk analysis. The two approaches are discussed separately. The basic quantitative input to probability seismic risk analysis is a probability distribution of magnitudes within the critical crustal volume; this distribution is obtained by fitting a Gumbel 3 distribution to an enlarged set of data while the limiting analysis concentrates on the short term crustal rupture associated with an expected individual earthquake. It is suggested that the two methods of analysis model different aspects of the problem with vastly different time factors and complement each other. A seismic study is briefly described where both approaches were considered, applied to the city of Tehran, Iran. Author (ESA)

N76-31803 D'Appolonia (E.) Consulting Engineers, Inc., Brussels (Belgium).

SOIL-STRUCTURE INTERACTION FOR NUCLEAR POWER PLANTS

J. R. Hall, Jr. and J. F. Kissenpfennig *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 113-119 refs (For availability see N76-31787 22-46)

Some of the basic principles of soil-structure interactions are reviewed and the advantages and limitations of lumped parameters and finite element approaches are discussed. An approach for extending the lumped parameter model to include deeply embedded foundations is presented. Finally, the state-of-the-art of field and laboratory measurements of dynamic subsoil properties is discussed briefly. Author (ESA)

N76-31804 Niedersaechsisches Landesamt fuer Bodenforschung, Hannover (West Germany).

SEISMIC NOISE INVESTIGATIONS: A METHOD FOR SEISMIC MICROZONING IN AREAS OF NUCLEAR POWER PLANTS

M. Steinwachs *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 123-131 refs (For availability see N76-31787 22-46)

The noise method requiring exact study of a site relative to the position of noise sources is described. In Europe and the U.S. frequently standardized seismic data are used for designing nuclear power plants which are secure from effects of earthquakes. Not considered in the standardized data are, generally, the seismic soil amplifications, i.e. the amplification of the earthquake waves by the near surface layer. The discussion is restricted to the seismic effects of the unconsolidated sediment layer of the soil. The calculated resonant frequencies can be checked by recording seismic signals generated by microearthquakes, explosions, or microseismic noise. The seismic noise at localities in the Federal Republic of Germany was investigated. The dominant frequencies in soil amplification were investigated in the vicinity of a planned nuclear power plant in South Germany. Author (ESA)

N76-31805 D'Appolonia (E.) Consulting Engineers, Inc., Brussels (Belgium).

SAFE SHUTDOWN EARTHQUAKE AND OPERATING BASIS EARTHQUAKE DETERMINISTIC AND PROBABILISTIC EVALUATIONS

W. J. Johnson and D. K. Shukla *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 139-145 refs (For availability see N76-31787 22-46)

The current probabilistic and deterministic procedures to determine the Safe Shutdown and Operating Basis Earthquakes (SSE and OBE) are reviewed to establish the basic seismic design criteria for nuclear power plants. Nuclear practice establishes the SSE using a deterministic procedure referring to past seismicity and the OBE as a fraction of the SSE. The probabilistic procedures recently proposed extrapolate recurrence rate data on past earthquakes. This approach is not judged appropriate to establish rare events such as the SSE because the limited data sample precludes far extrapolation. Conversely, the probabilistic approach has merit in determining the more frequent OBE event. Author (ESA)

N76-31806 D'Appolonia (E.) Consulting Engineers, Inc., Brussels (Belgium).

SEISMIC DESIGN SPECTRA FOR NUCLEAR POWER PLANTS: STATE-OF-THE-ART

A. P. Michalopoulos and D. K. Shukla *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 147-155 refs (For availability see N76-31787 22-46)

The state-of-the-art of definition standard design reponse spectra is reviewed and illustrated by data relevant to hard or rock sites. The state-of-the-art of nuclear power plant design involves the use of design response spectra together with a modal analysis of a mathematical idealization of the actual structure. The design response spectra give the maximum response

of a family of single degree of freedom viscously damped oscillators to ground acceleration as a function of time. A set of design response spectra applicable to rock sites is recommended.
Author (ESA)

N76-31807 Technischer Uerberwachungs-Verein Rheinland, e.V., Cologne (West Germany). Inst. fuer Reaktorsicherheit.
EARTHQUAKE DESIGN OF NUCLEAR POWER PLANTS
Hans Joachim Kaestle *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 157-163 (For availability see N76-31787 22-46)

The earthquake risk to nuclear power plants and the problems involved in protecting nuclear power plants against earthquakes are discussed. Methods for calculating the maximum loadings for buildings, structures, and components are reviewed. They include the response spectrum modal analysis, the time history modal analysis, and the time history analysis. ESA

N76-31808 Laboratorio Nacional de Engenharia Civil (LNEC), Lisbon (Portugal).
SEISMIC RISK STUDIES FOR NUCLEAR POWER PLANTS
Artur Ravara *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 185-192 refs (For availability see N76-31787 22-46)

The seismicity at Ferrel and Sizandro sites located on the west coast of Portugal, preliminary choice for nuclear power plant sites, was investigated by means of macro and microzoning studies, aiming at a rational choice of location for the country's first nuclear power plant. Macrozoning studies consisted of a statistical estimate of maximum ground acceleration, based on available data on epicenter location, magnitude, and MM intensities of earthquakes in Portugal since 1902. Probability distributions of maximum yearly acceleration and seismic risk charts of the country were obtained. Microzoning studies consisted of the analysis of soil vibration records using TNT charges blasted offshore. Author (ESA)

N76-31809# Physics Lab. RVO-TNO, The Hague (Netherlands).
SOLUMAT: A PROGRAMME FOR MEASURING THE INFLUENCE OF THE ATMOSPHERE ON CONTRAST TRANSFER
A. A. VanMeeteren and J. VanSchie Dec. 1975 86 p refs (Contract A72/KL/027)
(PhL-1975-46; TDCK-67163) Avail: NTIS HC $5.00

The results of the SOLUMAT (Statistical investigation of the Luminance of the Atmosphere) program for measuring contrast decrease in the atmosphere are presented. For the past 3.5 years an automated observatory has performed measurements (by day only) of contrast decrease and related variables. Data were handled and interpreted by a computer. Distributions of many variables are presented in tabular form. In addition a few special treatments of the data are discussed. Author (ESA)

N76-31810# Physics Lab. RVO-TNO, The Hague (Netherlands).
RAMAN LIDAR: A FEASIBILITY STUDY
C. W. Lamberts and H. Dekker Dec. 1975 91 p refs
(PhL-1975-49; TDCK-67211) Avail: NTIS HC $5.00

A feasibility study on the remote detection of gaseous constituents of the atmosphere by means of the Raman lidar technique is presented. The theoretical formula for the Raman cross section is derived from the quantum theory of inelastic scattering. The Raman lidar equation is discussed and the results of an extensive literature survey on the numerical values of the differential vibrational Raman cross section of atmospheric nitrogen are summarized in a table. The set-up and the calibration of the Raman lidar system are described, and lidar measurements of the absolute value of the cross section of atmospheric nitrogen are reported. Formulas for the minimum detectable concentration and range are presented. Author (ESA)

N76-31811# Stockholm Univ. (Sweden). Inst. of Meteorology.
A NOTE ON THE CONCEPTS OF AGE DISTRIBUTION AND TRANSIT TIME IN NATURAL RESERVOIRS
Anders Bjoerkstroem Apr. 1976 11 p refs
(AC-35) Avail: NTIS HC $3.50

A general relation between the average age and the residence time distribution of material in a reservoir at steady state is derived. Given the average residence time, it is shown that the average age increases with increasing standard deviation in the residence time distribution. Author (ESA)

N76-31812# Aerodyne Research, Inc., Bedford, Mass.
EXPERIMENTAL MEASUREMENT OF NO(+) RADIATIVE LIFETIME Final Report, Jun. 1974 - Sep. 1975
Bien Fritz Nov. 1975 55 p refs
(Contract F19628-74-C-0204; DNA Proj. NWED-QAXHI002)
(AD-A022682; ARI-RR-73; AFCRL-TR-75-0613) Avail: NTIS CSCL 04/1

The location and integrated absorption coefficient of the R-3 line for the v – 1 to v – 2 vibrational transition in NO(-) has been experimentally measured. The location of the line center was determined to be 2327.20 - or - 0.01/cm, 0.07/cm higher than the previosly calculated value. The line was found to be Doppler broadened, giving an integrated absorption coefficient of 240 - or - (-100, -75)/sq cm atm. This value would be consistant with a thermal equilibrium ground state integrated absorption coefficient of 280/sq cm atm, one half the value of previous observations and a factor of 3 higher than theoretical predictions. the accuracy in the ground state equilibrum value is - or - a factor of 2 due to the uncertainity in relative vibrational populations. GRA

N76-31813# Alaska Univ., College. Geophysical Inst.
NOCTILUCENT CLOUD OBSERVATIONS COORDINATED WITH ROCKET TEMPERATURE SOUNDINGS IN CENTRAL ALASKA Final Report, 15 Jul. 1974 - 30 Mar. 1975
William J. Stringer 20 Jan. 1976 44 p refs
(Contract DAHC04-75-G-0003)
(AD-A022625; UAG-NLC-74, ARO-12752.1-GS) Avail: NTIS CSCL 04/1

During the summer of 1973 and 1974, the Geophysical Institute and the U.S. Army Meteorological Rocket Program cooperated in a small joint study to determine whether any correlation could be found between the appearance of noctilucent clouds and lower mesospheric temperature profiles. Noctilucent cloud observations were performed by the Geophysical Institute while mesospheric temperature profiles were obtained for altitudes below 70 km by parachute-borne thermistors released from standard 'Dart' payloads carried aloft by 'Super Loki' rocket motors. Temperature profiles obtained from grenade temperature soundings were used to extrapolate the lower mesospheric temperature profiles to the mesopause. Successful observations required temperature profiles to be obtained during clear sky conditions. These requirements were met on four occasions during the period of joint study. Preliminary analysis of data indicates that occurrence of noctilucent clouds may be independent of mesopause temperature. However, it is recognized that the quality of data is insufficient to justify emphasizing these results. GRA

N76-31814# Aerospace Corp., El Segundo, Calif. Lab Operations.
LOWER THERMOSPHERIC COMPOSITION INFERRED FROM TOTAL DENSITY MEASUREMENTS AND THE OGO-6 450-km MODEL Interim Report
Barbara K. Ching 24 Mar. 1976 22 p refs
(Contract F04701-75-C-0076)
(AD-A023046; TR-0076(6960-04)-5; SAMSO-TR-76-59) Avail: NTIS CSCL 04/1

It is shown that the thermospheric composition can be determined from the total density if the composition at another height is known. The method is based on the assumption that the composition at the two heights is related via diffusive equilibrium; however, a knowledge of the temperature profile linking the two altitudes is not required. The method has been applied using lower thermospheric density data at 175 km (averaged over a 2 week period of low geomagnetic activity) and the composition at 450 km as specified by the OGO-6 model. Assuming that the OGO-6 model predictions were appropriate for the conditions of the density measurements, the uncertainty in the inferred composition is of the order of the uncertainty in the density. Although the observed average density at 175 km was consistent with the CIRA-1972 model, the inferred composition was substantially different, the O/N2 ratio being similar to the predictions of the low-altitude OGO-6 model. The

inferred O/N2 ratio varied from about 0.8 at low latitudes to 0.4 at high auroral latitudes. These ratios, while lower than those suggested by Von Zahn and Moe, are consistent with some recent in situ measurements. Author (GRA)

N76-31815# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

TEMPERATURE DEPENDENCE OF THE QUENCHING, OF VIBRATIONALLY EXCITED N2 NO AND H2O Interim Report

M. E. Whitson 25 Mar. 1976 21 p refs

(Contract F04701-75-C-0076)

(AD-A023507; TR-0076(6970)-8; SAMSO-TR-76-71) Avail: NTIS CSCL 04/1

A photoionization technique for the detection of vibrationally excited nitrogen (N2*) was applied to study the quenching of N2*(v=1) by NO and H2O over the temperature range 300 to 993 K by means of a flow system with microwave excitation of the nitrogen. The rate coefficient for quenching N2*(v=1) by NO is (2.2 + or - 0.9) x 10 to the -15th power cucm/sec at 293 K, (3.24 + or - 1.3) x 10 to the -15th power cucm/sec at 525 K, (6.5 + or - 2.5) x 10 to the -15th power cucm/sec at 700 K, and (1.6 + or - 0.6) x 10 to the -14th power cucm/sec at 993 K. These rate coefficients are in reasonable agreement with previous measurements and are the first measurement in the 500 to 993 K range. The rate coefficient for quenching N2*(v=1) by H2O is (1.24 + or - 0.5) x 10 to the -14 the power cucm/sec at 293 K, (2.5 + or - 1) x 10 to the -14th power cucm/sec at 523 K, (5.1 + or - 2) x 10 to the -14th power cucm/sec at 963 K, and (1.1 + or - 0.4) x 10 to the -13th power cucm/sec at 963 K. These data are in reasonable agreement with published acoustic impact tube, and shock-tube measurements. Author

N76-31816# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

AURORAL ELECTRON SPECTRA IN THE ATMOSPHERE Interim Report

Janet G. Luhmann 25 Mar. 1976 28 p refs

(Contract F04701-75-C-0076)

(AD-A023450; TR-0076(6260-20)-8; SAMSO-TR-76-60) Avail: NTIS CSCL 04/1

An approximate analytic description of the energy spectrum of auroral electrons at any atmospheric depth is derived for incident spectra of arbitrary shape. The practical application of this expression describing the spectrum is illustrated by the calculation of energy deposition vs. altitude profiles. GRA

N76-31817# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.

THEORETICAL AND NUMERICAL STUDIES OF THE UPPER ATMOSPHERE USING SATELLITE AND ROCKET MEASUREMENTS Final Report, 4 Dec. 1973 - 3 Dec. 1975

Carol I. Foley, Susan H. Devay, and Jeffrey M. Forbes 31 Jan. 1976 116 p refs

(Contract F19628-73-C-0134; DNA Proj. NWED-QAXHD028) (AD-A022677; BC-SDAL-76-1; AFGL-TR-76-0025) Avail: NTIS CSCL 04/1

Ionospheric phenomena were studied based on analyses of satellite and rocket borne instrumentation measurements. Areas of interest included determination of atmospheric number densities, ionic compostion, ionization production rates, and scale heights. Various geopotential and density models were used to verify results. A three-dimensional numerical model of the quiet-time thermosphere was developed. Some of the computer programs written and developed for these studies are included in this report. Author (GRA)

N76-31818# Environmental Research and Technology, Inc., Concord, Mass.

COMBINED MICROWAVE-INFRARED SOUNDING STUDIES Final Report, 1 Dec. 1974 - 1 Jun. 1975

Roger L. Weichel 12 Jan. 1976 74 p refs

(Contract F19628-75-C-0062; AF Proj. 6698)

(AD-A022681; AFCRL-TR-75-0572) Avail: NTIS CSCL 04/1

This report describes implementation and characteristics of two software systems, the Statistical Method of Parameter Estimation (Environmental Research and Technology, Inc.) and the Minimum Information Method (Air Force Global Weather Central). These systems are designed for investigating the retrieval of atmospheric temperature profiles from remotely sensed radiometric data. Significant features of the programs are discussed and preliminary results for simulated infrared, microwave, and combined infrared-microwave measurements are presented for the statistical method. Further development is suggested and approaches to optimum use of combined infrared-microwave measurements are outlined. Additionally, two appendices are provided which summarize recent developments in a variational-iterative computation scheme for radiative transfer calculations which included scattering effects of clouds and precipitation, and the use of near IR measurements for cloud-snow discrimination. Both developments have great potential in investigating remote sensing techniques. Author (GRA)

N76-31819# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

IONOSPHERIC IRREGULARITIES: HAES PROGRAM SUPPORT. HAES REPORT NO. 29 Final Report, 1 Oct. 1974 - 30 Sep. 1975

Robert D. Sears 30 Sep. 1975 72 p refs

(Contract DNA001-75-C-0098; DNA Proj. NWET-AAXHX615) (AD-A023468; LMSC-D460783; DNA-3782F) Avail: NTIS CSCL 04/1

Photometric measurements of visible and near infrared emissions from the auroral ionosphere were made in support of the DNA HAES (High Altitude Nuclear Effects) experiments, ICE CAP and EXCEDE in Alaska during 1975. The intensity and motions of irregularities in the emission intensity were interpreted in terms of the energy deposit by precipitating particles and Joule Heating, and in terms of ionospheric irregularities in neutral density created by winds and acoustic gravity waves. A revised and upgraded model for computing ionospheric Joule heating in the auroral region from three beam photometer measurements of auroral motions is presented. Tentative results of experiments conducted in support of ICE CAP and EXCEDE rocket experiments are presented. Over 160 hours of photometric data obtained at the Chatanika, Alaska, field site during February through April 1975 is summarized. GRA

N76-31820# Naval Research Lab., Washington, D.C.

ULTRAVIOLET EXTINCTION MEASUREMENTS AT THE CHESAPEAKE BAY Final Report

J. A. Curcio and G. L. Knestrick Mar. 1976 16 p refs

(NRL Proj. A02-17)

(AD-A023182; NRL-MR-3238) Avail: NTIS CSCL 04/1

This report presents results of a previously unreported investigation of atmospheric attenuation in the ultraviolet region carried out in the spring of 1962 at the Chesapeake Bay Division of NRL. Measurements were made over a path 1/2 mile long in the spectral region 0.25 micrometers to 0.535 micrometers. The extinction measurements showed the ozone concentrations to be between 0.026 and 0.04 ppm. Several observations showed the presence of pollutant gases which were assumed to be a mixture of SO sub 2 and NO sub 2. The presence of NO sub 2 seems to be necessary to account for the observed extinctions below 0.30 micrometers. GRA

N76-31821# Oklahoma State Univ. Research Foundation, Stillwater. Electronics Lab.

SUPPORT SERVICES FOR IR ROCKET PAYLOADS Final Report, 1 May 1972 - 31 Jan. 1976

Richard F. Buck and R. Michael Fike 31 Mar. 1976 109 p refs

(Contract F19628-72-C-0712; DARPA Order 1366; AF Proj. 8692)

(AD-A023459; AFGL-TR-76-0031) Avail: NTIS CSCL 04/1

The report summarizes services supplied in support of a series of Infrared payload instruments, launched aboard upper air research rockets by the Air Force Cambridge Research Laboratories. Circuit details are presented for a number of specific payload support packages which combined telemetry and trajectory electronics. Special ground support equipment provided in connection with the support is also described, with comments on operational experience gained in Field Services, both within the United States and abroad. GRA

N76-31822*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
IN SITU MEASUREMENTS OF THE MESOSPHERE AND STRATOSPHERE
Charles Crosky 23 Jan. 1976 130 p refs
(Grants NGR-39-009-218; DAHC04-75-G-0031)
(NASA-CR-148742; AD-A023013; PSU-IRL-SCI-442) Avail: NTIS HC $6.00 CSCL 04/1

The operation of a subsonic, Gerdien condenser probe for in situ measurements of the mesosphere and stratosphere is presented. The inclusion of a flashing Lyman alpha ultraviolet source provides an artifically produced ionization of particular constituents. Detailed theory of operation is presented and the data results from two flights are shown. A great deal of fine structure in mobility is observed due to the presence of various hydrated positive ions. The effect of the Lyman alpha source in the 35 km region was to dissociate a light hydrate ion rather than produce additional ionization. At the 70 km region, photodissociation of the heaviest ions (probably ice crystals) was also observed. GRA

N76-31823# Stanford Research Inst., Menlo Park, Calif.
NATURAL LIGHTING PARAMETERS AND THEIR SIMULATION IN LABORATORY TESTS
E. T. Pierce Feb. 1976 19 p refs
(Contract N00014-74-C-0134; NR Proj. 082-206; SRI Proj. 3062)
(AD-A023487; Scientific-Note-E) Avail: NTIS CSCL 04/1

The paper summarizes our knowledge of natural lightning. The derivation of flash incidence from thunderstorm day statistics is first discussed. Information on lightning parameters is then reviewed; these parameters include peak current, rate of current rise, intermediate current, continuing current, action integral, and several others. Parameters of importance in aviation hazards are given particular attention. The characteristics of positive flashes are examined, and the question of the representativeness of discharges to tall structures is considered. The electromagnetic fields radiated by close flashes are described. Finally, the realism of lightning models, specifications, and simulation tests, as they relate to natural lightning, are critically discussed. Author (GRA)

N76-31824# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES, SUMMARY AND REVIEW, 2 Final Report, 1 Sep. 1972 - 31 Jul. 1975
Seibert Q. Duntley, Richard W. Johnson, and Jacqeline I. Gordon Sep. 1975 79 p refs
(Contract F19628-73-C-0013; AF Proj. 7621)
(AD-A022675; SIO-REF-75-26; AFCRL-TR-75-0457) Avail: NTIS CSCL 04/1

This report summarizes a 3-year period of collecting optical atmospheric data both at night and during the day chiefly with airborne instruments. Four field expeditions were made between September 1972 and June 1975 in various locations in the United States and Europe, primarily during the winter and summer. Measurements were made in five spectral regions, as follows: three narrow band optical filters with mean wavelengths of 478, 664, and 765 nanometers, and two broad band sensitivities, one representing the S-20 multiplier phototube incorporating an ultraviolet rejection filter with a mean wavelength of 532 nanometers, the other representing the photopic response with a mean wavelength of 557 nanometers. Optical measurements included total scattering coefficient and sky and terrain radiance. These data were used to calculate natural irradiance on a horizontal plane surface, directional reflectance of terrain, atmospheric beam transmittance, path radiance, and directional path reflectance. The methods of data collection and data processing are reviewed, the resultant data bank described, and recommendations for further study and interpretation of the data are proposed. Author (GRA)

N76-31825# TRW Systems Group, Redondo Beach, Calif.
MONTE CARLO SIMULATION OF ION COLLECTION BY A ROCKET-BORNE MASS SPECTROMETER Interim Report
Takashi Sugimura Feb. 1976 38 p refs
(Contract F19628-74-C-0; AF Proj. 6687)
(AD-A023481; Scientific-2; AFGL-TR-76-0029) Avail: NTIS CSCL 04/1

A systematic parametric variation for the positive ion collection by a rocket-borne probe has been completed for the following parameters: speed ratio 3.10; non-dimensional front face potential -200; zero sidewall potential; Debye numbers from 0.01 to 1000; and Knudsen numbers from 0.007 to 1000. The effects of finite space charge on the vehicle are to lower the ion flux to the stagnation point. It is found that the ion flux follows a uniform trend for Knudsen numbers greater than 0.2, but becomes complicated for the near-continuum regime, e.g., Knudsen number equal to 0.007, which is discussed in detail. Author (GRA)

N76-31826# Teledyne Geotechnical, Garland, Tex.
EARTH NOISE IN THE 20 TO 100-SECOND PERIOD RANGE Final Report
E. J. Douze 9 Sep. 1975 63 p refs
(Contract F44620-73-C-0052)
(AD-A023292; TR-75-14; AFOSR-76-0376TR) Avail: NTIS CSCL 08/11

Experiments to investigate the sources of seismic noise in the period range of 20 to 100 seconds have been conducted at three observatories, Grand Saline and McKinney, Texas and Pinedale, Wyoming. For surface seismographs the main contributor to the noise is quasi-static earth motion caused by wind-generated pressure variations. These pressure variations were recorded by microbarographs and shown to be linearly related to the noise recorded by seismographs during windy periods. During windless periods frequency-wave number analysis shows that infrasonic waves contribute to the noise recorded by long-period seismometers. Attenuation of the effect of short wavelength wind-generated pressure variations can be accomplished by two means: burial of the seismometer below the surface and optimum filtering techniques. The depth of burial required to eliminate the wind-generated noise is approximately in agreement with theory. GRA

N76-31827# Computer Corp. of America, Cambridge, Mass.
DATA COMPUTER SUPPORT OF SEISMIC DATA ACTIVITY Quarterly Technical Report, 1 Nov. 1975 - 31 Jan. 1976
31 Jan. 1976 14 p refs
(Contract MDA903-74-C-0227; ARPA Order 2613)
(AD-A023598) Avail: NTIS CSCL 08/11

Project activity can be divided into four catagories: (1) SIP development and network bandwidth considerations; (2) TBM acquisition and integration into the Data computer; (3) coordination with the seismic community; and (4) seismic-data related Data computer development. One section in this report is devoted to each of these catagories. GRA

N76-31828# Joint Publications Research Service, Arlington, Va.
HEAT TRANSFER OF THE SOIL AND ATMOSPHERE AT NORTHERN AND TEMPERATE LATITUDES
A. V. Pavlov Jan. 1976 305 p refs Transl. into ENGLISH of the book "Teploobmen pochvy s atmosferoi v severnykh i umerennykh shirotakh territorii" SSSR, Yakutsk, Yakutskoya Knizhnoya Izdatel'stvo, 1975 Prepared for Army Cold Regions and Engineering Lab., Hanover, N. H.
(AD-A022485; CRREL-TL-511) Avail: NTIS CSCL 08/13

The Monograph was written from materials of systematic heat-balance investigations carried out by the author over a period of more than 15 years in regions with different climatic and frozen conditions (the Moscow area, northern Yenisey, Central Yakutiya, and Bol'shezemel'skaya tundra). The complex method of conducting remote observations of elements of heat transfer between the soil and atmosphere is described. Processes of heat and mass transfer in snow and vegetation covers are considered. The results of many years of investigating the intrayearly course of the components of the external heat transfer of natural landscapes are analyzed. The relationship between the forest--open area heat-transfer components is studied experimentally for the first time for Siberian conditions. A great deal of attention was devoted to study of the thermal conditions of the upper layer of the earth's mantle. A number of new methods of forecasting the elements of the thermal conditions of the soil (freezing-thawing and the mean annual temperature) is described. GRA

N76-31829# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

PLASMA WAVES IN THE DISTANT MAGNETOTAIL

D. A. Gurnett, C. A. Frank, and R. P. Lepping Mar. 1976 70 p refs

(Contract N00014-76-C-0016)

(AD-A023624; U-of-Iowa-76-9) Avail: NTIS CSCL 20/9

In this study we identify the principal types of plasma waves which occur in the distant magnetotail and investigate the relationship of these waves to simultaneous plasma and magnetic field measurements made on the same spacecraft. The observations used in this study are from the IMP-8 spacecraft which passes through the magnetotail at radial distances ranging from about 23.1 to 46.3 R sub e. Three principal types of plasma waves are detected by IMP-8 in the distant magnetotail: broad-band electrostatic noise, whistler-mode magnetic noise bursts and electrostatic electron cyclotron waves. The electrostatic noise is a broad-band emission which occurs in the frequency range from about 10 Hz to a few kHz and is the most intense and frequently occurring type of plasma wave detected in the distant magnetotail. This noise is found in regions with large gradients in the magnetic field near the outer boundaries of the plasma sheet and in regions with large plasma flow speeds, directed either toward or away from the earth. The whistler-mode magnetic bursts observed by IMP-8 consist of nearly monochromatic tones which last from a few seconds to a few tens of seconds. These noise bursts occur in the same region as the broad-band electrostatic noise, although much less frequently, and are thought to be associated with regions carrying substantial field-aligned currents. GRA

N76-31830# Georgia Inst. of Tech., Atlanta.

ATMOSPHERIC ACOUSTIC GRAVITY MODES AT FREQUENCIES NEAR AND BELOW LOW FREQUENCY CUTOFF IMPOSED BY UPPER BOUNDARY CONDITIONS

Allan D. Pierce, Wayne A. Kinney, and Christopher Y. Kapper 1 Mar. 1976 34 p refs

(Contract F19628-74-C-0065; AF Proj. 7639)

(AD-A022978; Scientific-1; AFCRL-TR-75-0639) Avail: NTIS CSCL 04/1

Perturbation techniques are described for the computation of the imaginary part of the horizontal wave number (k sub I) for modes of propagation. Numerical studies were carried out for a model atmosphere terminated by a constant sound speed (478m/sec) half space above an altitude of 125 km. The GR(0) and GR(1) modes have lower frequency cutoffs. It was found that for frequencies less than 0.0125 radian/sec, the GR(1) mode has complex phase velocity; K sub I varying from near zero up to a maximum of 0.0003 with analogous results for the GR(0) mode. There is an extremely small frequency gap for each mode for which no poles in the complex k plane corresponding to that mode exist. These mark the transition from undamped propagation to damped propagation. In the complete Fourier synthesis, branch line contributions compensate for the absence of poles in these gaps. Computational procedures are described which facilitate the inclusion of the low frequency portions of these modes in the waveform synthesis. Author (GRA)

N76-31831# University Coll., London (England). Dept. of Physics and Astronomy.

DETERMINATION OF AIR DENSITY, TEMPERATURE AND WINDS AT HIGH ALTITUDE Scientific Report, 1 Feb. 1972 - 30 Jun. 1975

Gerald V. Groves Aug. 1975 31 p refs

(Grant AF-AFOSR-2264-72; AF Proj. 8605)

(AD-A021277; AFCRL-TR-75-0523; SR-3) Avail: NTIS CSCL 04/1

The report contains a paper entitled 'Latitude and height dependences of solar atmospheric tides'. The latitude dependences are expressed by Hough functions which are presented graphically for symmetric and asymmetric diurnal and semidiurnal modes. Two height dependences are developed for each mode: one is a function which weights the heating rate at any level in proportion to its response in the surface pressure oscillation; the other is a function which weights the heating rate at any level in proportion to its response in the tidal fields at a given higher level. A typical heating rate profile is adopted to which these weighting functions are applied. The surface pressure oscillation and tidal fields at 80 km are discussed in relation to the levels of heating from which they are mainly excited. GRA

N76-31832# Stanford Research Inst., Menlo Park, Calif. Molecular Physics Center

INVESTIGATION OF ION-ION RECOMBINATION CROSS SECTIONS Report for 19 Oct. 1974 - 18 Oct. 1975

D. L. Huestis, J. T. Moseley, D. Mukherjee, J. R. Peterson, and F. T. Smith 19 Nov. 1975 77 p

(Contract F19628-75-C-0050; SRI Proj. PYU-3784)

(AD-A021286; SRI-MP-75-73; AFCRL-TR-75-0606) Avail: NTIS CSCL 04/1

An experimental and theoretical investigation was made of ion-ion mutual neutralization processes relevant to the chemistry of the D-region of the earth's ionosphere. In the experimental work, the primary effort was directed toward modifying the merged-beam apparatus, which had been designed to produce beams of small ions, so that it would produce hydrated ion beams of sufficiently high intensity and narrow energy spread. In the theoretical effort, a study of the ion-charged dipole interaction problem, which is being used as a model for the complex interaction involving two clustered ions, has been continued. A classical dynamical study of this system in two dimensions using a fixed parabolic trajectory approximation and also a less accurate perturbation approximation was completed. In order to extend this work to the case of three-dimensional motion, a powerful semiclassical perturbation technique, in which the collision S-matrix is expressible in closed form in terms of tabulated functions, was developed. Using this approach preliminary calculations of orbital capture cross sections for the O(-) and No(+) system were carried out. A detailed study of the NO2(-).H2O system was initiated in an effort to extend an approach from rotational excitation of diatomic molecules to the excitation of bending modes in simple hydrated ions.

Author (GRA)

N76-31833# National Center for Atmospheric Research, Boulder, Colo.

APPROXIMATE METHODS OF CALCULATING TRANSMISSION BY BANDS OF SPECTRAL LINES

C. D. Rodgers (Oxford Univ., England) Apr. 1976 55 p refs

(Contract NSF C-760)

(PB-252367/8; NCAR-TN-116-IA) Avail: NTIS HC $4.50 CSCL 04A

Approximations that have been found useful in calculating the transmission of molecular gases in planetary atmospheres are described. The use of band models and empirical models are included. A variety of techniques are described for dealing with the case of transmission through an atmospheric path which is inhomogeneous in the distribution of temperature pressure and absorber concentration. Author (GRA)

N76-31834# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

ROCKET MEASUREMENTS OF OH EMISSION PROFILES IN THE 1.56 AND 1.99 MICROMETER BANDS Environmental Research Papers

W. F. Grieder, K. D. Baker, A. T. Stair, Jr., and J. C. Ulwick 28 Jan. 1976 70 p refs

(AF Proj. 7670)

(AD-A022955; AFCRL-TR-76-0057; AFCRL-ERP-550) Avail: NTIS CSCL 07/4

Results of radiometer measurements of infrared Hydroxyl (OH) emissions from five rocket flights are presented. Two of the rocket payloads were flown from Poker Flat Rocket Range, Alaska and three were flown from White Sands Missile Range, Nex Mexico. Four of the flights were flown during night-time conditions and one (at WSMR) was flown during twilight (CHI – 99 deg). Each rocket payload was instrumented with liquid nitrogen cooled dual-channel radiometers to measure infrared OH emissions from the vibration-rotation bands 2-0 through 5-3 (1.56 micrometer channel) and the 7-5 through 9-7 (1.99 micrometer channel). The rocket data shows that the principle OH emissions in the bands cited occurs in a thin layer 8 to 10 km thick with peak emission near an altitude of 89 km. The ratio of night-time 1.56 micrometer to 1.99 micrometer radiance is constant, at a value of 1.4, up to an altitude of 80 km regardless of latitude. At twilight, this ratio is larger at

low altitudes (60 km) and diminishes with increasing altitude. Estimated night-time peak volume emission rates at WSMR are 1 megaphotons per cm per sec per micrometer in the 1.56 micrometer band and 0.7 megaphotons per cu cm per sec per micrometer in the 1.99 micrometer band. Author (GRA)

N76-31835# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MID-INFRARED SPECTRAL BEHAVIOR OF METAMORPHIC ROCKS Environmental Research Papers
Graham R. Hunt and John W. Salisbury 22 Sep. 1976 66 p refs
(AF Proj. 7670)
(AD-A022676; AFCRL-TR-76-0003; AFCRL-ERP-543) Avail: NTIS CSCL 08/7

Mid-infrared (6 to 40 micrometers) spectra of metamorphic rocks and rock-forming minerals are presented, and their molecular vibration bands identified. While igneous and sedimentary rocks are typically composed of a few major rockforming minerals in different proportions, metamorphic rocks may contain many different mineral components, some of which are vertually unique to the metamorphic environment. As a result, metamorphic rocks display a great range in spectral behavior. However, similar metamorphic facies exhibit similar spectral behavior, and this behavior is readily understandable in terms of rock mineralogy. This understanding is aided by the fact that metamorphic recrystallization is usually accompanied by a sharpening of the spectral features. GRA

N76-31836# Naval Oceanographic Office, Washington, D.C.
GRAVITY PREDICTION BY PSEUDO-DENSITY PROFILING M.S. Thesis. Final Report
Donald W. Hill Oct. 1975 73 p refs
(AD-A022869; NOO-RP-14) Avail: NTIS CSCL 08/5

This paper investigates the problem of predicting gravity values in ocean areas which are sparsely surveyed. Some of the prediction techniques currently employed are summarized and a brief review of gravity reductions pertinent to this study are presented. In an effort to use accepted statistical algorithms supplemented by other supporting geophysical data, gravity prediction by the method of pseudo-density profiling is then developed. This interpolating procedure uses the correlation of free-air gravity and bathymetry to predict values in ocean areas where gravity observations are sparse but bottom topography is known in detail. An integral part of the method is optimizing the gravity/bathymetric relationship by low-pass filtering the bathymetry. Conclusions of this study are based on examples of both one- and two-dimensional applications and illustrate that under the proper conditions, the pseudo-density method produces results which are superior to other interpolation techniques. In areas where coverage is not so sparse, departure of predicted gravity from observed values provides a method for inferring lateral variations in density associated with regional geology and tectonics. GRA

N76-31837# Naval Oceanographic Office, Washington, D.C.
A NUMERICAL ICE FORECASTING SYSTEM
Donald J. Gerson Oct. 1975 147 p refs
(AD-A023183; NOO-RP-8) Avail: NTIS CSCL 08/12

This forecasting system provides estimates of current ice thickness and forecasts of ice formation and thickness for 62 locations in the Arctic. It also provides forecasting aids such as selected sea surface temperatures, snow depths, mean daily air temperature trends, and degree-day accumulations. The observations are obtained on magnetic tape from the National Meteorological Center on a near-real-time basis. The forecast techniques are statistical processes based on local climatology. The system presently is producing outputs on a daily basis. It is expandable in design so that as new forecasting methods are developed they can be integrated into the program. Since the data base consists of all the world's synoptic weather observations, the expansion may be into fields other than ice prediction. GRA

N76-31838# Naval Surface Weapons Center, Dahlgren, Va.
COMPARISON OF DOPPLER AND OPTICAL POLE POSITION OVER TWELVE YEARS Final Report
R. J. Anderle Mar. 1976 15 p refs
(AD-A022790; NSWC/DL-TR-3464) Avail: NTIS CSCL 08/5

Positions of the earth's spin axis with respect to the crust are computed by three independent systems: using data from the 5 International Latitude Stations (ILS), using data from 40 or so astronomical observatory stations submitting data to the Bureau International de L'Heure (BIH), and using data from 20 or so Doppler stations in the Defense Mapping Agency (DMA) network. DMA data for the 1964-1970 period have significant errors due to approximations in computational methods used in this period. ILS data for the period 1970-1975 have significant periodic and a secular differences from BIH or DMA data as compared to the consistency between BIH and DMA data.
Author (GRA)

N76-31839# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
SURFACE WAVES: SOURCE AND PATH PROPERTIES Final Report, 1 Nov. 1973 - 31 Oct. 1975
Donald J. Weidner and Alan L. Kafka 28 Jan. 1976 46 p refs
(Contract F19628-74-C-0092; ARPA Order 1795; AF Proj. 1792)
(AD-A023632; AFGL-TR-76-0013) Avail: NTIS CSCL 17/10

The seismic surface wave contains information about the depth of the source. To extract this information, the effect of propagation must be known. We find that unconsolidated sediments can effectively erode the short period energy. The results of this study suggest that much care must be taken before the absence of short period surface waves is interpreted as an effect of focal depth. Deep earthquakes definitely exhibit a different Rayleigh wave amplitude than shallow events. In addition, a higher mode Rayleigh wave appears to dominate the long period vertical record. We conclude that both phenomena may be used as a depth diagnostic. We failed to confirm the utility of source phase for identifying deep events. The source phase may be useful for resolving shallow depth events.
Author (GRA)

N76-31840# Wisconsin Univ., Milwaukee. Dept. of Geological Sciences.
MULTIPLE SEISMIC EVENTS Semiannual Technical Report
Robert W. Taylor and David E. Willis 25 Feb. 1976 35 p refs
(Grant AF-AFOSR-2543-73; ARPA Order 1827)
(AD-A023296; AFOSR-76-0332TR; SATR-5) Avail: NTIS CSCL 17/10

The effects of station coverage on the detection threshold existing throughout an area were quantitatively investigated. The calculations were applied to the NTS area to demonstrate the changes in the detection thresholds occurring in five year intervals since 1933. The results demonstrate the need for quantitative consideration of station placement to ensure maximum detection capability. GRA

N76-31841# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
NONLINEAR INTERACTION OF INTERNAL GRAVITY WAVES Ph.D. Thesis Johns Hopkins Univ.
Charles Henry McComas, III 1975 121 p refs
(Contract NSF C-760)
(PB-252832/1; NCAR/CT-35) Avail: NTIS HC $5.50 CSCL 08C

This investigation concerns the weak transfer of energy in various models of the internal wave spectrum by nonlinear resonant interaction of triads of waves whose wavenumbers and frequencies satisfy K1 plus or minus K2 = K and (omega 1) plus or minus (omega 2) = omega. Three limiting cases of triads with widely disparate wavenumber, frequencies, or both, which we designate induced diffusion, elastic scattering, and subharmonic instability, dominate the numerically computed transfers of a contrived spectrum of possible relevance to the atmosphere and three models of the oceanic internal wave spectrum by Garrett and Munk. The diffusive mechanism predicts equilibrium spectra which are in general agreement with the two latest GM models of oceanic observations at high wavenumber. This diffusion mechanism is applicable to interaction of internal waves with the background flow as well. The basic result is that special, simplified cases of resonant interactions are important in determining some of the gross features of the internal wave spectrum. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-31842 Washington Univ., Seattle.
TEMPERATURE INVERSIONS CAPPING ATMOSPHERIC BOUNDARY LAYERS Ph.D. Thesis
Roland Beach Stull 1975 242 p
Avail: Univ. Microfilms Order No. 76-17649

A theory explaining the rate that fluid is entrained into a turbulent, mixed layer across a horizontal density interface is presented. This theory is used to predict the rise rate of temperature inversions capping atmospheric boundary layers. By integrating the turbulent kinetic energy equation over the depth of the mixed layer and assuming that turbulence dissipation rates are proportional to production rates, an equation is derived relating the potential energy change and entrainment rate to four major terms: (1) buoyant production of energy due to heating at the earth's surface; (2) mechanical production due to wind shear at the earth's surface; (3) mechanical production due to wind shear and dynamic instabilities such as Kelvin-Helmholtz waves at the inversion interface; and (4) energy losses due to internal gravity waves. It is shown that most previous published theories are just special cases of this general energetics theory.
Dissert. Abstr.

N76-31843 State Univ. of New York, Buffalo.
THE ZONAL DIFFUSE CLOUD CLIMATIC MODEL Ph.D. Thesis
Richard Lawrence Temkin 1976 189 p
Avail: Univ. Microfilms Order No. 76-17064

Recent concern about man's influence on climate has led researchers in attempts to understand this complex subject and propose models which possibly could predict future climate states. A zonally averaged model for the Northern Hemisphere was developed with cloud feedback incorporated within each of six zones. The treatment of the solar radiation included water vapor and ozone absorption, aerosol and cloud scattering, as well as solar zenith angle dependence. Surface albedo determination was based upon the average latitudinal ice and snow lines. Meridional annual energy transport was divided into atmospheric mean transport (using the concept of circulation cells), atmospheric eddy transport and oceanic transport. The latter two transports are based on eddy conductivity coefficients. They include a latitudinal dependence in their parameterizations through their relation to the shear of the zonal velocity and the Coriolis deflection, respectively. With the model tuned to the present day steady state, new steady state solutions were found for variations of environmental conditions.
Dissert. Abstr.

N76-31844# World Meteorological Organization, Geneva (Switzerland).
COST AND STRUCTURE OF METEOROLOGICAL SERVICES WITH SPECIAL REFERENCE TO THE PROBLEM OF DEVELOPING COUNTRIES
Etienne A. Bernard 1975 65 p refs
(WMO-426; TN-146; ISBN-92-63-10426-3) Avail: NTIS HC $4.50; WMO, Geneva Sw. Fr. 18

The financial, material and human resources required to apply meteorological information to economic and social development are many and vary from country to country. To investigate these differences, WMO carried out a survey to obtain objective data on the cost, structure and facilities of meteorological services. Part 1 is the result of an analysis of the information recovered from 74 countries. Part 2 complements this detailed analysis by contrasting the present role of meteorology in developed and developing countries and analyzing the potential applications of meteorology with particular reference to the developing countries. Recommendations to enhance the economic development of such countries are made. For individual titles, see N76-31845 through N76-31846.

N76-31845 World Meteorological Organization, Geneva (Switzerland).
WMO SURVEY OF THE COSTS OF METEOROLOGICAL SERVICES: GLOBAL RESULTS AND CONCLUSIONS
In its Cost and Struct. of Meteorol. Serv. with Spec. Reference to the Probl. of Develop. Countries 1975 p 1-30 refs (For availability see N76-31844 22-47)
Copyright.

A presentation of the objective data, findings and conclusions of a survey on the cost of meteorological services is given. The background of the survey and the reasons for circulating a questionnaire are discussed together with an explanation of the criteria used in grouping countries. Tables give data on the numbers of class 1, 2, 3, and 4 meteorological personnel including the expenditures by types of application, staff salaries, and unit contributions to the budget. These aspects are successively analyzed, extrapolated and discussed briefly.
ESA

N76-31846 World Meteorological Organization, Geneva (Switzerland).
STATE OF METEOROLOGY IN THE DEVELOPING COUNTRIES
In its Cost and Struct. of Meteorol. Serv. with Spec. Reference to the Probl. of Develop. Countries 1975 p 32-52 refs (For availability see N76-31844 22-47)
Copyright.

Some of the paradoxical situations of meteorology in developing countries which are mainly due to their budgetary disparities at the international, national and internal levels are discussed and compared with the situation in industrialized countries. Areas where applications of meteorology and climatology could be used to further economic improvements are considered and suggestions for improving the use of meteorological information in developing countries are made.
ESA

N76-31847# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF LECTURE NOTES IN MARINE METEOROLOGY FOR CLASS 3 AND CLASS 4 PERSONNEL
H. O. Mertins 1976 227 p refs
(WMO-434; ISBN-92-63-10434-4) Avail: NTIS HC $8.00; WMO, Geneva Sw. Fr. 25

Lecture notes suitable for the specialized training of class III and class IV personnel in marine meteorology and physical oceanography are given for the following areas: (1) surface observations at sea; (2) wind speed and direction; (3) atmospheric pressure; (4) temperature and humidity; (5) sea surface temperature; (6) ice observations; (7) variability; (8) surface currents; (9) marine climatology, and (10) marine meteorological services.
ESA

N76-31848# World Meteorological Organization, Geneva (Switzerland).
CONTROLLED CLIMATE AND PLANT RESEARCH
R. J. Downs and H. Hellmers 1976 71 p refs
(WMO-436; TN-148; ISBN-92-63-10436-8) Avail: NTIS HC $4.50; WMO, Geneva Sw. Fr. 12

The developments which have taken place in plant growth chambers in recent years as a result of changes in the lighting systems are outlined followed by a description of the parameters, their design and measurement, controlled in growth chambers. Special design growth chambers such as dew and mist chambers and seed germinators are discussed and the concept, objectives and criticisms of phytotrons are described. The uses and limitations of controlled environments are discussed. An extensive bibliography is included.
ESA

N76-31849# World Meteorological Organization, Geneva (Switzerland).
WMO: THE ACHIEVEMENT AND THE CHALLENGE
1976 49 p
(WMO-410; ISBN-92-63-10410-7) Avail: NTIS HC $4.00; WMO, Geneva Sw. Fr. 6

The use of meteorology as a science and the historical background to the formation of the World Meteorological Organization are outlined. Two of its larger programs - the World Weather Watch and the Global Atmospheric Research Programs - are described together with the organization and services of WMO. The new challenges faced by WMO in food production; water resources; environment pollution; marine and aviation meteorology; human settlements and weather modification are discussed.
ESA

N76-31850# Royal Netherlands Meteorological Inst., De Bilt.
STUDY ON THE SYSTEM MIX OF RADIOSONDE AIRCRAFT AND SATELLITE OBSERVATIONS IN THE NORTH ATLANTIC REGION. OBSERVATIONAL CHARACTERISTICS AND DATA PROCESSING
H. M. deJong 1976 90 p refs
(KNMI-WR-76-5) Avail: NTIS HC $5.00

The space-based satellite radiance system (NOAA series) and the surface-based radiosonde/rawin and aircraft reporting systems, constituting the mix system are described. Special attention is paid to the monitoring of the performance of the air reporting system. Data processing before preparation of upper air charts and insertion in numerical weather prediction models is dealt with. A method to derive the absolute geopotential height in aircraft locations from all available data in the system mix is discussed. The evaluation of a geopotential theorem requires the introduction of some graph theoretical concepts in the network of available data points. The processed data, when subjected to an additional selection procedure and interpolation to the nearest standard pressure levels, together with updated satellite data, contribute to a better definition of the physical state of the atmosphere. Processing of meteorological data from aircraft equipped with automatic data acquisition units is discussed.
Author (ESA)

N76-31851# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE INTER-GOVERNMENTAL PLANNING MEETING FOR THE FIRST GARP GLOBAL EXPERIMENT
Feb. 1976 36 p Prepared jointly with ICSU
(GARP-Spec-Rept-18) Avail: NTIS HC $4.00, WMO, Geneva

The objectives of the global experiment are presented followed by a report on the activities of the panel. An evaluation of the requirements and national commitments to the global experiment in terms of the observing and data management systems and general management is made. Related programs proposed to be conducted during the global experiment are listed. A summary of state commitments is given and unfulfilled requirements are noted.
ESA

N76-31852# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE EXTRAORDINARY SESSION OF WMO EXECUTIVE COMMITTEE INTER-GOVERNMENTAL PANEL ON THE FIRST GARP GLOBAL EXPERIMENT
Feb. 1976 58 p Prepared jointly with ICSU
(GARP-Spec-Rept-19) Avail: NTIS HC $4.50; WMO, Geneva

The report on the extraordinary session comprises a review of actions taken by the Joint-Organizing Committee; follow up actions based on the inter-governmental planning meeting for the FGGE; World Weather Watch support to FGGE; the FGGE observing and data management systems; the management of the global experiment and related programs and experiments.
ESA

N76-31853# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAMME INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1975
Jan. 1976 259 p
(WMO-437; ISBN-92-63-10437-9) Avail: NTIS HC $9.00; WMO, Geneva Sw. Fr. 15

General remarks on the states of the overall Voluntary Assistance Program (VAP) are followed by guidelines for use in the implementation of World Weather Watch projects through VAP. Equipment required to implement VAP projects approved for 1975 is listed as are members contributions to VAP. The status of the implementation of VAP projects on 31 December 1975 is given together with full lists of individual VAP projects approved for circulation in 1975 and projects approved for circulation between 1968 and 1974 which have since been modified.
ESA

N76-31854# Stockholm Univ. (Sweden). Inst. of Meteorology.
WET DEPOSITION OF INORGANIC NITROGEN COMPOUNDS OVER THE OCEAN
Rolf Soederlund Mar. 1976 17 p refs
(Contract SWEDSRC-G-0223-065)
(AC-34) Avail: NTIS HC $3.50

An estimate of the yearly deposition of inorganic nitrogen compounds with natural precipitation over the oceans is made. Reported data on precipitation chemistry in the literature as well as data from the IMI air chemistry network was used. The yearly addition of nitrate is found to be in the range 5 to 16 x 10 at the 12th power g of NO3-N and of ammonium 8 to 26 x 10 at the 12th power g of NH4-N. Possible oceanic sources for these compounds are briefly discussed as well as errors and uncertainties in the estimate.
Author (ESA)

N76-31855# Stockholm Univ. (Sweden). Inst. of Meteorology.
AN EXAMPLE OF AIR-MASS TRANSFORMATION IN THE ARCTIC AND CONNECTED DISTURBANCES OF THE WIND FIELD
Hans Oekland Apr. 1976 33 p refs
(DM-20) Avail: NTIS HC $4.00

The rapid heating of arctic air-masses which are brought out over open water from the ice-covered polar area, is studied in a specific case. An associated modification of the wind field with a characteristic horizontal scale of a few hundred kilometers, is discussed with respect to its kinematic and dynamic properties.
Author (ESA)

N76-31856# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Meteorology Lab.
MINNESOTA 1973 ATMOSPHERIC BOUNDARY LAYER EXPERIMENT DATA REPORT
Yutaka Izumi and James S. Caughey 21 Jan. 1976 30 p refs
(AF Proj. 7655)
(AD-A023593; AFCRL-TR-76-0038; AFCRL-ERP-547) Avail: NTIS CSCL 04/2

A full-scale planetary boundary layer field experiment was conducted jointly by members of the Air Force Cambridge Research Laboratories, the Meteorological Research Unit, Royal Air Force, Cardington, England, and the Air Weather Service in late summer of 1973 in northwestern Minnesota. Direct measurements of vertical transport of momentum and heat, as well as vertical profiles of wind velocity and temperature, were obtained to altitudes of 1220 meters. Measurements were made from sensors mounted on a tower and on the cable of a barrage balloon. The data obtained for all the fully convective periods are presented in this report.
GRA

N76-31857# Analysis and Computer Systems, Inc., Burlington, Mass.
DEVELOPMENT OF NUMERICAL TECHNIQUES AND COMPUTER SYSTEMS FOR CLIMATOLOGICAL, IONOSPHERIC AND MICROWAVE PHYSICS APPLICATIONS
Final Report, 1 Mar. 1974 - 31 Dec. 1975
James F. Atkinson, Harold L. Dolan, Peter W. Lindstrom, and Kenneth L. Zwirble Jan. 1976 143 p refs
(Contract F19628-74-C-0122)
(AD-A022975; AFGL-TR-76-0006) Avail: NTIS CSCL 04/2

During the period of performance, over 60 programs were completed ranging in complexity and size from conversion of programs from one language or computer system to another, to design and development of a large scale system operating in a real time environment. The computer programs and numerical techniques developed under this contract supported AFGL research projects in such areas as: Climatology, Meteorology, Microwave Physics, Ionospheric Physics and Radio Astronomy. Some of these projects are outlined in this report.
GRA

N76-31858# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SATTEL: AN ARMY DEDICATED METEOROLOGICAL TELEMETRY SYSTEM
Joe Thomas (Idaho Univ., Moscow), George D. Alexander, and Marvin Dubbin Ft. Monmouth, N. J. Mar. 1976 31 p refs
(DA Proj. 1T1-62111-AH-71A)
(AD-A023286; ECOM-5587) Avail: NTIS CSCL 04/2

Certain real-time meteorological data that can be retrieved by satellite are extremely useful for Army battlefield operations.

To effectively and efficiently implement these data requires special characteristics for the satellite-to-ground telemetry link. The general description of such a telemetry system is presented. A subsystem of the satellite telemetry system is proposed that allows collection of surface meteorological data for relaying to users in addition to the satellite-retrieved data. Existing technology and systems are used as the basis for the concept and design. GRA

N76-31859# National Climatic Center, Asheville, N.C.
A STUDY OF FOG AND STRATUS FOR SELECTED CLOUD REGIONS
Nathaniel B. Guttman Dec. 1975 171 p refs Sponsored by Navy
(AD-A023591) Avail: NTIS CSCL 04/2

The report presents the Climatology of fog and stratus for selected cold regions. Three separate regions are studied; Alaskan Coastal, Greenland-Iceland Coastal and three Antarctic stations on the Ross Sea. The percent frequency of occurrence of fog and stratus is shown by isopleths. A graphical representation of the cumulative distribution of fog and stratus by air temperature completes the study. GRA

N76-31860# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12812 LANCE MISSILE NUMBER 2640, ROUND NUMBER 271 ECT, 19 NOVEMBER 1975
Nov. 1975 24 p
(DA Proj. 1T6-65702-D-127)
(AD-A022837; DR-900) Avail: NTIS CSCL 04B

Meteorological data gathered for the launching of 12812 Lance, Missile Number 2640, Round Number 271 ECT, are presented in tabular form. Author (GRA)

N76-31861# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
PROJECT SKYWATER. A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME 2 Data Environmental Statement
3 Apr. 1976 200 p refs
(PB-251114/5; INT-DES-76-10-Vol-2) Avail: NTIS HC $7.50 CSCL 04B

The purpose, scope and environmental impacts of cloud seeding for enhanced precipitation are presented in the format of a draft programmatic environmental statement. Two numerical ratings are given for each potential impact, one applicable to the research program and the other applicable of the technology being developed. Research to date indicates effects of widespread application of the technology under development would be significant over agricultural lands and generally insignificant in mountainous regions. GRA

N76-31862# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
PROJECT SKYWATER, ATMOSPHERIC WATER RESOURCES PROGRAM. A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME 1 Data Environmental Statement
5 Apr. 1976 304 p
(PB-251113/7; INT-DES-76-10-Vol-1) Avail: NTIS HC $9.75 CSCL 04B

The purpose, scope and environmental impacts of Project Skywater, a research program for the Great Plains area in cloud seeding for enhanced precipitation, are presented in the format of a draft programmatic environmental statement. Two numerical ratings are given for each potential impact, one applicable to the research program and the other applicable if the technology being developed by Project Skywater is applied in a long-term, continuous and widespread mode. The environmental effects of the research program generally are described as insignificant, if detectable. Research to date indicate effects of widespread application of the technology under development would be significant over agricultural lands and generally insignificant in mountainous regions. GRA

N76-31863# Missouri Univ., Columbia. Dept. of Atmospheric Science.
DETERMINATION OF THE FREQUENCY OF PRECIPITATION IN EXCESS OF DESIGN CRITERIA AT MORE THAN A SINGLE LOCATION DURING A HYDROLOGIC SEASON
Wayne L. Decker and Moersidi Soepawidjaja Dec. 1975 141 p refs Sponsored by Missouri Water Resources Research Center, Columbia, Mo.
(Contract DI-14-31-0001-5025)
(PB-252816/4; W76-07581; OWRT-A-078-MO(1)) Avail: NTIS HC $6.00 CSCL 04B

Stream contamination by agricultural wastes and chemicals, such as pesticides, fertilizers and animal excretions, can be minimized by impounding the runoff from the affected areas in settling basins or artificial lagoons. The design size of these lagoons depends on the expected rainfall amount and intensity, the physical condition of the soil, topography of the region, and the size of the drainage area. Rainfall characteristics and all other factors that are assumed to be known and constant are studied. Underestimating the runoff from excessive rainfall may result in an overflow of diverted water and stream pollution. Author (GRA)

N76-31864# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
THE FLORIDA AREA CUMULUS EXPERIMENT: RATIONALE, DESIGN, PROCEDURE, RESULTS, AND FUTURE COURSE Technical Report, 1963 - 1975
William L. Woodley and Robert I. Sax Jan. 1976 225 p refs
(PB-252658/0; NOAA-TR-ERL-354; NOAA-76030206; WMPO-6) Avail: NTIS HC $7.75 CSCL 04B

All aspects of NOAA's Florida Area Cumulus Experiment (FACE) are treated to provide a summary of current progress and problems, and to serve as a basis for discussion by the scientific community. As presently conceived, the FACE is a program to determine whether dynamic seeding can be used to augment precipitation over an extensive area by promoting larger and better organized convective systems. The FACE planning process, since its inception in 1970, is described. The measurement of convective rainfall in FACE using the Miami reflectivity rainfall rate relation receives extensive treatment. The plans for the FACE 1975 field program are detailed. GRA

N76-31865# Flow Research, Inc., Cambridge, Mass.
SPECTRAL MODELING OF ATMOSPHERIC FLOWS AND TURBULENT DIFFUSION Final Report
Arthur Bass and Steven A. Orszag Jan. 1976 155 p
(Contract EPA-68-02-1297)
(PB-252506/1; EPA-600/4-76-007) Avail: NTIS HC $6.75 CSCL 04B

This report presents a survey of discrete spectral and pseudospectral numerical methods to simulate atmospheric flow and turbulent diffusion. Some applications of these methods to air quality simulation modeling are presented. A three-dimensional spectral incompressible numerical model is described in detail. Computational resource limitations precluded successful evaluation of eddy Austauch coefficients. Some numerical results are presented for the rate of relaxation of anisotropic flows. Recommendations and suggestions for further research are made concerning the prospective utility of these spectral methods for air quality simulation modeling. GRA

N76-31866# National Center for Atmospheric Research, Boulder, Colo. Research Systems Facility.
GATE DROPWINDSONDE DATA USERS GUIDE
P. K. Govind, H. L. Cole, and J. H. Smalley Dec. 1975 235 p
(Grant NSF C-760)
(PB-252372/8; NCAR/4531/75-1) Avail: NTIS HC $8.00 CSCL 04B

The users guide is divided into two parts. Part I reviews the necessary background material fundamental to both parts. Dropwindsonde missions flown during the summer of 1974 in the GARP Atlantic Tropical Experiment are listed first. This is followed by a description of the achieved data set, the instrumentation, the data-processing, and data-validation procedures. In Part II, a comprehensive summary of each dropwindsonde sounding is provided in the form of data quality assessment logs. The logs include a plot of meteorological profiles; simple codes identify the quality of data through the depth of each sounding. These ratings have been compiled to assist the user

in making effective use of the data for his individual purpose. GRA

N76-31867# Control Data Corp., Minneapolis, Minn. Research Div.
OBJECTIVE TROPICAL STORM PARAMETERS FROM SATELLITE CLOUD PATTERNS Technical Report, Jun. - Sep. 1975
D. G. Dartt 2 Oct. 1975 64 p refs
(Contract N00228-75-C-2365)
(AD-A022650; NEPRF-TR-11-75(CDC); TR-1) Avail: NTIS CSCL 04/2

Procedures are described for objectively analyzing satellite cloud patterns for the purpose of defining indirect measures of intensity and orientation of tropical storms. One approach is based on properties of the distribution of centers of curvature for segments of concentric cloud bands associated with the storm. The magnitude and variability parameters of the center of curvature distribution appear related to storm intensity as estimated by the Dvorak T number. This result is based on a case history of growth-dissipation cycle of a single tropical storm. The major axis of the center of curvature distribution is an additional parameter that can be used to measure rotation of distinctive cloud features. In a second approach, curvature and convergence are calculated for individual spiral cloud bands throughout the storm. Maps of these parameters can be used to help diagnose storm intensity and also perhaps aid in predicting future storm development. GRA

N76-31868# Information Design, Inc., Bedford, Mass.
ANALYSIS OF CHEMICAL SMOKE RELEASES TO CHARACTERIZE STRATOSPHERIC/THERMOSPHERIC WIND FIELDS Final Report, 10 Apr. - 1 Dec. 1975
Sheldon B. Michaels, Jeffrey S. Morris, and Otis Philbrick Jan. 1976 10 p refs
(Contract F19628-75-C-0146; AF Proj. 6687)
(AD-A022678; AFGL-TR-76-0011) Avail: NTIS CSCL 04/2

Position data needed for triangulation of smoke trails was obtained from photographic films supplied by AFCRL. Interactive computer programs were developed to locate smoke puff centers and to estimate Gaussian radii. GRA

N76-31869# Washington Univ., Seattle. Cloud Physics Group.
RADAR AND AIRBORNE STUDIES OF RAINBANDS ASSOCIATED WITH FRONTS IN THE PACIFIC NORTHWEST
William M. Davis and Peter V. Hobbs 18 Nov. 1975 147 p refs
(Contract F19628-74-C-0066; AF Proj. 627A)
(AD-A022633; Scientific-2; AFCRL-TR-75-0621) Avail: NTIS CSCL 04/2

Several case studies of mesoscale rainbands associated with cyclonic storms in the Pacific Northwest are described. In one case study the following bands were identified: A 15 km wide band which preceded the warm front (and traveled faster than it); two warm-sector bands 40 km in width which moved parallel to the cold front; a warm-sector band which extended across the cold front; a narrow, intense band on the cold front (which produced some of the highest precipitation rates); a broad band just behind the cold front; ripple-like bands (possibly associated with roll-clouds) normal to the cold front and superimposed upon the broad band; and, two bands about 350 km behind the cold front. In another case study an occluded frontal system produced a narrow, intense rainband at the front and numerous post-frontal bands, fifteen of which are described in this report. The apparent effects of orography on dissipating a portion of a rainband are described. Also presented are airborne measurements of particle sizes in a 70 km wide rainband associated with an occluded front. GRA

N76-31870# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
BOUNDARY LAYER DUST OCCURRENCE. 2: ATMOSPHERIC DUST OVER THE MIDDLE EAST, NEAR EAST AND NORTH AFRICA
B. D. Hinds and G. B. Hoidale Dec. 1975 195 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A022637; ECOM-DR-75-4) Avail: NTIS CSCL 04/2

The report is designed to provide a guide to the occurrence of atmospheric dust over selected geographical areas for assessing the potential impact of naturally occurring atmospheric dust on military operations or systems. Tabularized data on the diurnal variation of the occurrence by month and on the duration factor for selected time periods throughout a year for blowing dust (visibility less than 11 km) and of dust storms (visibility less than 1 km) for 18 stations in the Middle East, 72 stations in the Near East, and 45 stations in North Africa are presented. Previously published climatological data on the occurrence of dust over the three geographical areas are summarized in an appendix by means of annotated references. GRA

N76-31871# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
STUDIES ON NUMERICAL MODELING AND MODIFICATION OF CYCLONE SCALE PRECIPITATION Final Report, 15 Sep. 1972 - 31 Dec. 1974
Ferdinand Baer, D. B. Rao, and Douglas Boudra Jan. 1976 69 p refs
(Contract DAHC04-73-C-0001)
(AD-A022470; ARO-11279.1-EN) Avail: NTIS CSCL 04/2

A fine-mesh limited area model has been developed both to predict precipitation over a limited geographic region, and to be utilized in experiments with precipitation modification. The model utilizes the primitive equations, incorporates fifteen levels in the vertical and has a basic grid length of 80 km. It shows many of the features of current models of its type, but lacks resolution in the boundary layer. Lateral boundary conditions are specified when needed from a data set which also provides initial conditions and comparisons for the forecasts. Finite-difference integrations are performed but spectral techniques are studied. Forecasts with the model show some fidelity to observations but some short-comings also. Setting one integration as a control, a number of experiments were performed with model modifications and compared to the control. In all cases, modification did not substantially alter the flow field over a 24 hour period. GRA

N76-31872# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES OF STRUCTURE IN THE PLANETARY BOUNDARY LAYER WITH A HIGH RESOLUTION LIDAR Summary Report, 15 Aug. 1972 - 14 Aug. 1975
E. W. Eloranta and J. A. Weinman 19 Jan. 1976 81 p refs
(Contract DA-ARO(D)31-124-73-G29)
(AD-A022471; ARO-10967.3-EN) Avail: NTIS CSCL 04/2

The following report is a summary of studies on planetary boundary layer visualization and remote determination of wind profiles by means of a high resolution lidar. These investigations rely on inhomogeneities in the natural aerosol distribution to delineate eddies in the boundary layer. Measurement of the rate of displacement of these eddies yield horizontal wind components. Author (GRA)

N76-31873# Uppsala Univ. (Sweden). Dept. of Meteorology.
MESOMETEOROLOGICAL STUDIES OF PRECIPITATION Final Report, 1973 - 1975
Tor Bergeron and Bengt Dahlstrom 31 Dec. 1975 26 p refs
(Contract DA-ERO-591-74-G0001; DA Proj. 2Mo-61102-B-52B)
(AD-A022484) Avail: NTIS CSCL 04/2

This report presents additional analysis and information emanating from Project Pluvius Study was done, at the meso-scale, on the propagation of detached, partly convective raining 'units' in the cases demonstrated by maps. Computer processing of the rainfall data was conducted, the treatment being focused on grid-point calculation of rainfall values and of areal rainfall. GRA

N76-31874# International Field Year for the Great Lakes Project Office, Ann Arbor, Mich.
IFYGL RAWINSONDE DATA ACQUISITION SYSTEM
C. J. Callahan, J. A. W. McCulloch, E. J. Aubert, and E. M. Rasmusson Jan. 1976 43 p refs Sponsored by NOAA
(PB-250968/5, IFYGL-TMS-6; NOAA-76020404) Avail: NTIS HC $4.00 CSCL 08H

Descriptions of the equipment, techniques, and procedures

used in collecting the data are provided. It also provides similar programs in the future with operational details on capability, performance, and cost factors as an aid to planning, logistics, and decision making. GRA

N76-31875# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
TORNADO-BORNE MISSILE SPEEDS Final Report
Emil Simiu and Martin Cordes Apr. 1976 64 p refs Sponsored in part by Nuclear Regulatory Commission, Washington, D. C. (PB-253111/9; NBSIR-76-1050) Avail: NTIS HC $4.50 CSCL 18E

At the request of the U.S. Nuclear Regulatory Commission (NRC) the National Bureau of Standards (NBS) has carried out an independent investigation into the question of tornado-borne missile speeds, with a view to assisting NRC in identifying pertinent areas of uncertainty and in estimating credible tornado-borne missile speeds - within the limitations inherent in the present state of the art. The investigation consists of two parts: (1) a study, covered in this report, in which a rational model for the missile motion is proposed, and numerical experiments are carried out corresponding to various assumptions on the initial conditions of the missile motion, the structure of the tornado flow, and the aerodynamic properties of the missile; (2) a theoretical and experimental study of tornado-borne missile aerodynamics, conducted by Colorado State Univ. (CSU) under contract with NBS, to be covered in a separate report by CSU. In the present report, the factors affecting missile motion, and their influence upon such motion, are examined. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-31876 Washington Univ., Seattle.
THE DECOMPOSITION OF CO-EXISTING RANDOM INCIDENT AND REFLECTED WAVE ENERGY Ph.D. Thesis
Dennis Bert Morden 1975 230 p
Avail: Univ. Microfilms Order No. 76-17571

The reflection characteristics of wind-generated waves are examined and a technique developed which allows an accurate separation of the incident and reflected wave spectra and direct calculation reflection coefficients. The sea state which occurs when random incident waves and their reflections co-exist does not lend itself to analysis by techniques commonly applied to progressive random waves. The resulting surface is shown to consist of modulations due to beat effects contained within a complicated standing wave envelope. The time-averaged energy density at any location is not equal to the sum of the average energy densities of the incident and reflected waves, but is also a function of a phase relationship. Wave data obtained at two locations on a normal to the reflecting surface can be used to decompose the co-existing wave spectra into separate incident and reflected spectra. The co-existing wave spectra are divided into frequency increments each of which are treated as independent inputs to the decomposition technique. The accuracy of the technique depends on the accuracy of the estimated spectra for the co-existing wave. Dissert. Abstr.

N76-31877# Woods Hole Oceanographic Institution, Mass.
DRIFTING BUOY LAGRANGIAN TEST Final Report
Peter M. Saunders 24 May 1976 61 p refs
Avail: NTIS HC $4.50

Test instrumentation consisting of a damped spar buoy supporting a current meter is described; its purpose is to evaluate the performance of a drogued buoy, that is to measure the slip of water past the drogue in response to wind, current shear and waves. Prototype test instrumentation tethered to a drogued buoy by a neutrally buoyant rigid horizontal spar underwent a 2 day sea trial. A rough weather trial of the test instrumentation was recommended in order to improve drogued buoy design, and to understand wave forces. Author

N76-31878# Delaware Univ., Newark. Dept. of Civil Engineering.
NUMERICAL MODELS FOR THE PREDICTION OF WAVE SET-UP AND NEARSHORE CIRCULATION
William A. Birkemeier and Robert A. Dalrymple Jan. 1976 130 p refs
(Contract N00014-76-C-0342)
(AD-A022694; TR-3) Avail: NTIS CSCL 08/3

A finite difference model for predicting time-dependent, wave-induced nearshore circulation is discussed. The formulation includes wave refraction, wave-current interaction, an anistropic bottom friction, wave set-up, wind effects and coastal flooding. Results are shown for three cases including: set-up in a wave channel due to steady waves and wave groups, circulation in a rectangular wave tank under oblique wave attack, and for wave and wind induced circulation on a longshore periodic beach. Important results are that tuned wave groups can incite seiching in an enclosed basin and harbors and that rip currents will be induced or maintained by the presence of surf zone channels. Author (GRA)

N76-31879# Informatics, Inc., Rockville, Md.
SOVIET MATERIAL ON INTERNAL WAVE EFFECTS, NUMBER 5, MARCH 1976
Stuart G. Hibben, John Kourilo, B. L. Shresta, and M. Ness 15 Mar. 1976 100 p refs
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A022472) Avail: NTIS CSCL 08/3

This collection of abstracts on generation and detection of internal waves is based on items listed in the fifth Bibliography of Soviet Material on Internal Waves, published 10 Nov 1975, which covers material received June-Oct 1975. The abstracts are divided into internal effects and surface effects, comprising active and passive measurement of wave states. An author index is appended. GRA

N76-31880# Massachusetts Inst. of Tech., Cambridge. Sea Grant Project Office.
THE SCIENCE, ENGINEERING, ECONOMICS AND POLITICS OF OCEAN HARD MINERAL DEVELOPMENT
1976 38 p Proceedings of the 4th Annual Sea Grant Lecture and Symposium, Cambridge, Mass., 16 Oct. 1975
(PB-253548/2; MITSG-76-1; NOAA-76031217) Avail: NTIS HC $4.00 CSCL 08I

A transcript recording of the sea grant lecture and symposium is provided. The discussion concentrated on manganese nodules and its potential possibilities. Author (GRA)

N76-31881# National Oceanographic Instrumentation Center, Washington, D.C.
LABORATORY AND FIELD TESTING RESULTS FOR THREE WAVE MEASUREMENT SYSTEMS
Apr. 1975 47 p Sponsored by NOAA
(PB-253135/8; NOAA-TM-NOS-NOIC-4; NOAA-76031903) Avail: NTIS HC $4.00 CSCL 08C

The National Oceanographic Instrumentation Center, National Ocean Survey, National Oceanic and Atmospheric Administration has completed laboratory and at-sea testing and evaluation on three wave-measurement systems, including: (1) the Ocean Research Equipment Co. Model 480 Acoustic Wave Gage, (2) the Bendix Corp. Model Q-17 Ducted-Impellers Wave Meter with Model S20 Readout, and (3) the Edo Western Corp. Model 389 Wavetrak. Results of this testing and evaluation are presented. Each system is described technically and manufacturers' specifications provided. The testing program is outlined in detail and results reported by comparison with pertinent manufacturers' specifications. Included are 22 illustrations. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-31882# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
ANALYSIS OF THE PREFERENTIAL RELEASE OF NEWLY SYNTHESIZED ACh BY CORTICAL SLICES FROM RAT BRAIN WITH THE AID OF TWO DIFFERENT LABELLED PRECURSORS

P. C. Molenaar and R. L. Polak (Sylvius Labs.) 1975 23 p refs Sponsored by the Promeso Found.
(MBL-1975-14; TDCK-66580) Avail: NTIS HC $3.50

The release of newly synthesized acetylcholine (ACh) by cortical slices from rat brain in the presence of 25 mM KCl was studied. The slices were incubated for 5 min in a medium containing both 2-(C-14)-pyruvate and choline labelled with 3 deuterium atoms 3-(D-2)-Ch in order to label at the same time the acetyl moiety and the choline moiety of ACh. The non-labelled ACh and the 3-(D-2)-ACh were measured by pyrolysis-gas chromatography/mass spectrometry, and the (C-14)-ACh by liquid scintillation counting. It was found that the newly formed (C-14)-ACh as well as the newly formed 3-(D-2)-ACh had a more than 2.5 times greater probability of being released than the preformed nonlabelled ACh. These findings strongly suggest that it is not simply the ACh synthesized immediately inside the nerve ending membrane from incoming undiluted labelled choline which is preferentially released, but that all newly formed ACh has a greater probability of being released than preformed ACh. No preferential release of newly formed ACh was observed when the incubation medium contained 5.6 mM pyruvate instead of 10 mM glucose + 0.6 mM pyruvate. The cause of this difference remains unexplained. Author (ESA)

N76-31883# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

THE ROLE OF INITIATION FACTOR-3 IN THE TRANSLATION OF T7- AND O80 trp MESSENGER RNA

Rob Benne (Calif. Univ., Davis) and Peter H. Pouwels 1975 22 p refs
(MBL-1975-15; TDCK-66582) Avail: NTIS HC $3.50

The deoxyribonucleic acid (DNA) dependent synthesis of proteins was studied with a system composed of DNA, washed ribosomes, centrifuged (150,000 xg) bacterial extract from Escherichia coli and purified initiation factors IF-1 and IF-2. Synthesis of active enzymes encoded by the tryptophan (trp)-operon of E. coli was found to depend strongly on the addition of IF-3, with the same IF-3 dependency for all 5 gene-products of this operon, irrespective of the presence of the promotor proximal gene trpE. Synthesis of T7 RNA polymerase with T7 DNA as a template, however, was completely independent of the addition of IF-3. The same difference in IF-3 requirement was found when the overall protein synthesis directed by these templates was compared. This difference could be related to the effect of IF-3 on the formation of initiation complexes with the in vitro prepared mRNA: initiation complexes are readily formed with T7 mRNA also in the absence of IF-3, whereas the formation of these complexes with O80trp mRNA depends almost completely on the presence of this factor. Author (ESA)

N76-31884# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

THE EFFECT OF ACTH-ANALOGUES ON MOTOR BEHAVIOR AND VISUAL EVOKED RESPONSE IN RATS

Otto L. Wolthuis and David deWied (Rudolf Magnus Inst. for Pharmacol.) 1975 23 p refs
(MBL-1975-17; TDCK-66581) Avail: NTIS HC $3.50

Averaged Visual Evoked Responses (VER) in cortical area 17 were recorded one hour after the administration of 7-l-phe ACTH (4-10) or 7-d-phe ACTH(4-10) to artificially ventilated rats, paralyzed with gallamine. In addition, the effects of these peptides on spontaneous motor behavior were analyzed. Results show that the latencies of all VER components remain unchanged and the amplitudes of the primary VER were unaffected. Measured at a wide variety of light intensities, however, the amplitudes of the VER afterdischarges were significantly and very similarly diminished by both peptides, the effect of 7-l-phe ACTH(4-10) being somewhat stronger than that of 7-d-phe ACTH(4-10). These results support the notion, advanced by others, that these peptides have an effect on a central nervous system vigilance regulating system, yet do not explain the reported opposite effects on active avoidance behavior of the two related peptides. The effects appear specific since spontaneous motor behavior, as index of changes in generalized arousal, is unaffected by these two peptides.
Author (ESA)

N76-31885# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

ENHANCING EFFECT OF RADIORESISTANT SPLEEN CELLS ON THE PRIMARY IMMUNE RESPONSE AGAINST SHEEP RBC BY MOUSE SPLEEN CELLS IN VITRO

F. H. Lubbe and O. B. Zaalberg Sep. 1975 13 p refs
(MBL-1975-19; TDCK-66738) Avail: NTIS HC $3.50

Irradiated spleen cells cultured for 3 days caused a stimulation of the primary in vitro immune response by normal spleen cells. These irradiated spleen cells were fractionated by velocity sedimentation and the fractions were tested for their stimulating activity. Only the macrophage enriched fractions were found to cause stimulation. The macrophages in these fractions were stuffed with erythrocytes and dead cells. The fractions, enriched in thymus derived cells, had no effect on the immune response. Irradiated spleen cells cultured for 24 hr caused inhibition. It has not yet been determined whether this inhibition was due to some transient change in the macrophage population during incubation. The stimulating effect by the irradiated spleen cells from SPF (specific pathogen free) mice was strongly reduced, which could be ascribed at least partly to the naturally occurring low number of macrophages in the spleens of these mice. Author (ESA)

N76-31886# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

INVESTIGATION ON THE HYDRODYNAMIC PROPERTIES OF DNA IN FORMAMIDE-WATER MIXTURES WITH VARIOUS IONIC STRENGTHS

A. C. M. VanderDrift and W. Sluiter Sep. 1975 57 p refs
(MBL-1975-20; TDCK-66736) Avail: NTIS HC $4.50

The hydrodynamic behavior of four homogeneous linear double-stranded phage deoxyribonucleic acids (O29, T7, PP8, and T4) were investigated by means of viscometry and velocity sedimentation at 20 C in formamide-water mixtures, 50% w/w at various concentrations of NaCl. The experimental data can be adequately analyzed in terms of the worm-like chain model modified for excluded volume effects. With increasing ionic strength the excluded volume parameter shows no significant changes, whereas the Kuhn statistical segment length and the effective Stokes diameter of the hydrodynamic units decrease; the mutual distance between the unit elements, however, remains rather constant. From these results it is concluded that formamide mainly destabilizes the intramolecular base-stacking whereas the NaCl primarily shields local intramolecular electrostatic repulsions which is attended by obvious desolvation. Author (ESA)

N76-31887# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands)

PIRACETAM AND ACQUISITION BEHAVIOR IN RATS: ELECTROPHYSIOLOGICAL AND BIOCHEMICAL EFFECTS

O. L. Wolthuis and V. J. Nickolson Dec. 1975 35 p refs Sponsored by the FUNGO Found. for Med. Res.
(MBL-1975-24; TDCK-67177) Avail: NTIS HC $4.00

Effects of piracetam on cortical electrical phenomena in rats following visual stimulation were studied. An investigation of the biochemical mechanisms underlying the effects of the drug was started by studying possible effects on protein and energy metabolism. It was found that piracetam increases the chance that a light stimulus is followed by a large surface negative cortical potential (peak) in animals paralyzed with tubocurarine. Injection of the drug also increases the chance that the peaks will follow the flash after a constant interval. Piracetam has no effect on the spontaneous occurrence of these peaks. In animals paralyzed with gallamine no peaks occur and piracetam causes an increase of the amplitudes of the classical visually evoked response, both of the primary response as well as of the after-discharges. It is concluded that piracetam facilitates central registration mechanisms, an effect which could be responsible for the enhancement of acquisition by the drug.
Author (ESA)

N76-31888# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

BINDING OF RADIATION-INDUCED PHENYLALANINE RADICALS TO DNA: INFLUENCE ON THE BIOLOGICAL ACTIVITY OF THE DNA AND ON ITS SENSITIVITY TO THE INDUCTION OF BREAKS BY GAMMA RAYS

G. P. VanderSchans, C. J. S. VanRijn, and J. F. Bleichrodt Nov. 1975 29 p refs
(MBL-1975-27; TDCK-67114) Avail: NTIS HC $4.00

When an aqueous solution of double-stranded deoxyribonucleic acid (DNA) of bacteriophage PM2 containing phenylalanine and saturated with N2O is irradiated with gamma rays, radiation induced phenylalanine radicals are bound covalently. Under the conditions used about 25 phenylalanine molecules may be bound per lethal hit. Also for single-stranded PM2 DNA most of the phenylalanine radicals bound are nonlethal. Evidence is presented that in double-stranded DNA an appreciable fraction of the single-strand breaks is induced by phenylalanine radicals. Radiation products of phenylalanine and the phenylalanine bound to the DNA decrease the sensitivity of the DNA to the induction of single-strand breaks. There are indications that the high efficiency of protection by radiation products of phenylalanine is due to their positive charge, which will result in a relatively high concentration of these compounds in the vicinity of the negatively charged DNA molecules. Author (ESA)

N76-31889# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
RADIOSENSITIZATION OF MAMMALIAN CELLS BY DIAMIDE
O. Vos, G. A. Grant (Defence Res. Estab., Ottawa), and L. Budke Jan. 1976 22 p refs
(MBL-1976-1; TDCK-67285) Avail: NTIS HC $3.50

The effect of diamide on the radiosensitivity of T-cells was investigated under oxic and anoxic conditions. The compound was found to sensitize the cells under both conditions. Under oxic conditions, exposure for 10 min before and during irradiation to 0.1, 0.5, and 1.0 mm diamide produced dose-modifying factors of 0.81, 0.60, and 0.55, respectively. Under anoxic conditions exposure for 10 min before and during irradiation to 0.5 mm produced a dose-modifying factor of 0.34. When the cells in oxic conditions were exposed for just 20 min before irradiation, the sensitizing effect was smaller, but some sensitization effect was still apparent after a 120 min interval between diamide treatment and irradiation. Diamide also sensitized the cells after irradiation but this effect was less than when it was present during irradiation. It is proposed that sensitization is due to lack of capacity for repair of radicals by hydrogen transfer and biochemical repair processes. Author (ESA)

N76-31890# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
KINETICS AND LOCALIZATION OF IgE TETANUS ANTIBODY RESPONSE IN MICE IMMUNIZED BY THE INTRATRACHEAL, INTRAPERITONEAL AND SUBCUTANEOUS ROUTES
Jan L. J. Gerbrandy, Ernst A. VanDura, and John Bienenstock (McMaster Univ.) 1976 24 p refs Sponsored partly by Ontario Thoraric Soc. and Med. Res. Council of Can.
(MBL-1976-2; TDCK-67286) Avail: NTIS HC $3.50

The heterologous adoptive cutaneous anaphylaxis system was used to determine the kinetics of appearance of IgE producing cells in various lymphoid tissues of mice following intratracheal, intraperitoneal, or subcutaneous immunization with tetanus toxoid and Bordetella pertussis organisms. Intratracheal and intraperitoneal immunization produced similar patterns of response with the bronchial lymphoid nodes quantitatively exceeding the responses in other lymphoid tissues. Although a dissociation was seen between responses obtained in various lymphoid tissues following subcutaneous and intraperitoneal or intratracheal immunization, no real evidence for a local mucosal response, such as has been reported for IgA, was obtained. These results lend experimental support to the observations that intratracheal and intraperitoneal immunization routes are most effective in production of IgE antibodies. Author (ESA)

N76-31891# School of Aerospace Medicine, Brooks AFB, Tex.
THE BIOLOGICAL SIGNIFICANCE OF RADIO-FREQUENCY RADIATION EMISSION ON CARDIAC PACEMAKER PERFORMANCE Interim Report, Jan.-Aug. 1975
John C. Mitchell and William D. Hurt Jan. 1976 23 p refs
(AF Proj. 7757)
(AD-A022886; SAM-TR-76-4) Avail: NTIS CSCL 06/18

The effect of radiofrequency (RF) radiation emission on cardiac pacemaker function is a unique bioeffects phenomenon. Dependent on the pacemaker type and design, and on the frequency, peak E-field intensity, pulse width, and effective pulse repetition rate of the incident RF signal, the pacemaker may cut off completely, revert to a fixed interference-rejection mode of operation, experience intermittent disruption, or be totally unaffected. Experimental evidence is presented for a wide variety of tests conducted under controlled laboratory conditions and in the vicinity of numerous types of RF emitters prevalent in U.S. population centers. These test results are discussed in terms of their clinical significance, technical feasibility of designing pacemakers to avoid electromagnetic interference, and appropriate design goals to achieve overall RF environmental compatibility. Author (GRA)

N76-31892# IIT Research Inst., Chicago, Ill.
GERMINATION AND EARLY GROWTH OF SUNFLOWERS IN WEAK ELF ELECTROMAGNETIC FIELDS Final Report
G. M. Rosenthal, Jr. May 1975 38 p refs
(Contract N00039-73-C-0030)
(AD-A023092) Avail: NTIS CSCL 06/18

Sunflowers (Helianthus annuus) were raised in a weak ELF electromagnetic field under controlled laboratory conditions and in a greenhouse. The field levels were 10 or 1 volt/meter rms electric field and 1 gauss rms magnetic field at 75 Hz. The observations and statistical analysis of these experiments are documented in the report. It has been concluded that under field conditions the small, but probably real, effects of a weak electromagnetic field would be indistinct from, and interact with, those brought about by any other micro-environmental factors. GRA

N76-31893# IIT Research Inst., Chicago, Ill.
ELF ELECTROMAGNETIC FIELD EFFECTS ON LIFE FORMS, BIBLIOGRAPHY
Vincent C. Formanek Apr. 1976 183 p refs
(Contract N00039-73-C-0030; IITRI Proj. E6249)
(AD-A023094; IITRI-E6249-TR-2) Avail: NTIS CSCL 06/18

During the course of a study, supported by an IITRI project with the Electric Power Research Institute, some 2300 references were identified which were then reduced to some 800 citations. With that as a starting point, this bibliography has been prepared to aid in the assessment of extremely low frequency biological research. This bibliography emphasizes the following: (1) AC electric and magnetic fields, biological effects between 45-75 Hertz; (2) AC electric and magnetic fields, alpha-rhythm interactions between 1-15 Hertz; (3) AC electric and magnetic field influences on patients with cardiac pacemakers; (4) Behavioral influences: (a) migration (b) orientation (c) sensing-detection. Author (GRA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-31894*# Martin Marietta Corp., Denver, Colo.
SEPARATION OF GRANULOCYTES FROM WHOLE BLOOD BY LEUKOADHESION, PHASE 1 Final Report
Jun. 1976 64 p refs
(Contract NAS9-14545)
(NASA-CR-147883; MCR-76-272) Avail: NTIS HC $4.50 CSCL 06A

Capillary glass tubes are investigated for the separation and retrieval of large quantities of viable granulocytes and monocytes from whole blood on a continuous basis from a single donor. This effort represented the feasibility demonstration of a three phase program for development of a capillary tube cell separation device. The activity included the analysis and parametric laboratory testing with subscale models required to design a prototype device. Capillary tubes 40 cm long with a nominal 0.030 cm internal diameter yielded the highest total process efficiency. Recovery efficiencies as high as 89% of the adhering cell population were obtained. Granulocyte phagocytosis of latex particles indicated approximately 90% viability. Monocytes recovered from the separation column retained their capability to stimulate human bone marrow colony growth, as demonstrated in an in vitro cell culture assay. Author

N76-31895*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
NUCLEAR EMULSION MEASUREMENTS OF THE ASTRONAUTS' RADIATION EXPOSURE ON THE APOLLO-SOYUZ MISSION
Hermann J. Schaefer and Jeremiah J. Sullivan 23 Jun. 1976 23 p refs
(NASA Order T-81D)
(NASA-CR-150916; NAMRL-1228) Avail: NTIS HC $3.50 CSCL 06R

On the Apollo-Soyuz mission each astronaut carried one passive dosimeter containing nuclear photographic emulsions, plastic foils, TLD chips, and neutron-activation foils for recording radiation exposure. This report is limited to the presentation of data retrieved from nuclear emulsions. Protons, most of them trapped particles encountered in numerous passes through the South Atlantic Anomaly, contributed by far the largest share to the mission dose. Their linear energy transfer (LET) spectrum was established from track and grain counts in a G.5 emulsion which is used for medium and high energies, and from ender counts in a K.2 emulsion which is used for low energies. The total mission fluence of protons was found to be equivalent to a unidirectional beam of 448,500 square centimeters. The broad spectrum was broken down into small LET intervals, which allowed for the computation of absorbed doses and dose equivalents. The totals are 51 millirad and 74 millirem. Counts of disintegration stars in K.2 emulsion are incomplete at present. While a total of 467 stars were identified, counting their prong numbers is still in progress. It was concluded that the Apollo-Soyuz astronauts' radiation exposure as such did not contain anything out of the ordinary that would seem to require special attention. Author

N76-31896*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS OF LUMINESCENT SYSTEMS TO INFECTIOUS DISEASE METHODOLOGY
Grace Lee Picciolo, E. W. Chappelle, J. W. Deming, M. A. McGarry, D. A. Nibley, H. Okrend, and R. R. Thomas Sep. 1976 88 p refs Submitted for publication
(NASA-TM-X-71190; X-726-76-212) Avail: NTIS HC $5.00 CSCL 06E

The characterization of a clinical sample by a simple, fast, accurate, automatable analytical measurement is important in the management of infectious disease. Luminescence assays offer methods rich with options for these measurements. The instrumentation is common to each assay, and the investment is reasonable. Three general procedures were developed to varying degrees of completeness which measure bacterial levels by measuring their ATP, FMN and iron porphyrins. Bacteriuria detection and antibiograms can be determined within half a day. The characterization of the sample for its soluble ATP, FMN or prophyrins was also performed. Author

N76-31897# Los Alamos Scientific Lab., N.Mex.
STATUS REPORT ON ELECTRONIC IDENTIFICATION
D. M. Holm, R. E. Bobbett, A. R. Koelle, J. A. Landt. W. M. Sanders, S. W. Depp, and J. C. Hensley 1975 11 p refs Presented at Ann. Meeting of the US Animal Health Assoc., Portland, Oreg., 3 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2312; Conf-751161-1) Avail: NTIS HC $3.50

A significant milestone was passed in September 1975 with the successful operation of a subdermally implanted, temperature indicating transponder having hybrid circuitry. This transponder had no batteries and showed that an implant transponder could be powered by an external microwave beam and transmit encoded temperature information back to the receiver. The encoding of temperature was done because it was very similar to identification, but required much less circuitry. The microwave power levels at the animal skin were well within established safety limits. Additional work needs to be performed on optimizing circuitry and antenna design. Author (ERA)

N76-31898# United Nations Scientific Committee on the Effects of Atomic Radiation.
DOSIMETRIC IMPLICATIONS OF THE EXPOSURE TO THE NATURAL SOURCES OF IRRADIATION
D. J. Beninson, A. Bouville (Commissariat a l'Energie Atomique, France), B. J. OBrien (Inst. of Nuclear Physics, New Zealand), and J. O. Snihs (National Inst. of Radiation Protection, Sweden) 1975 54 p refs Presented at the Intern. Symp. on Areas of High Natural Radioactivity, Pocos de Caldas, Brazil, 16-20 Jun. 1975
(CEA-CONF-3113; Conf-750671-3) Avail: ERDA Depository Libraries HC $4.50

Natural radiation is of two origins, extraterrestrial and terrestrial. Extraterrestrial radiation originates in outer space as primary cosmic rays and reaches the atmosphere, with which the incoming energy and particles interact, giving rise to secondary cosmic rays to which living beings on the earth's surface are exposed. Terrestrial radiation is emitted from radioactive nuclides present in varying amounts in all soils and rocks, the atmosphere and the hydrosphere, and from those radionuclides that, transferred to man through food chains or by inhalation, are deposited in his tissues. Terrestrial radioactivity, therefore, leads to both external and internal exposure. Data are summarized as the radiation dose and dose rate to human populations from natural radiation. NSA

N76-31899# California Univ., Livermore. Lawrence Livermore Lab.
PERSONNEL MONITORING MEASUREMENTS
R. V. Griffith 23 Feb. 1976 11 p refs Presented at NBS Symp. on Measurements for the Safe Use of Radiation, Gaithersburg, Md., 1 Mar. 1976 Sponsored by ERDA
(UCRL-77816; Conf-760301-2) Avail: NTIS HC $3.50

The two most important personnel monitoring problems are development of personnel neutron dosimeter and in-vivo measurement of plutonium at sublung burden levels. Although there are a few techniques under development to attack these problems, satisfactory long term solutions will require much more work. As the development in nuclear power and medicine continue, the need for solutions to these problems will intensify. Author (NSA)

N76-31900# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
TABULATED CHARACTERISTICS OF A PROPOSED 2 DEG FUNDAMENTAL OBSERVER
J. J. Vos 1975 28 p refs
(IZF-1975-9; TDCK-67176) Avail: NTIS HC $4.00

Tables of chromaticities, color matching functions, and receptor system primaries for a 2 deg fundamental observer are presented as well as tables of receptor sensitivities and intraocular absorption. ESA

N76-31901# Walter Reed Army Inst. of Research, Washington, D.C.
THE INFLUENCE OF OXYHEMOGLOBIN AFFINITY ON TISSUE OXYGEN CONSUMPTION
Alden H. Harken and Monty Woods 27 Aug. 1975 8 p Submitted for publication
(DA Proj. 3A1-62110-A-821)
(AD-A023093) Avail: NTIS CSCL 06/16

In an intact animal or patient, any shift in oxyhemoglobin affinity is inevitably associated with concurrent fluctuation in numerous other determinants of oxygen delivery. For this reason, the influence of hemoglobin affinity for oxygen on tissue oxygen consumption has been incompletely evaluated. The purpose of this study was to investigate the influence of oxyhemoglobin affinity as the sole variable of oxygen delivery in an isolated perfused canine hindlimb. A membrane lung system which allowed precise control of blood flow, temperature, arterial oxygen content and arterial pH was established. Twelve isolated canine hindlimbs were alternatively perfused with autologous stored and fresh blood in parallel perfusion systems. A decreased hemoglobin affinity for oxygen appeared to permit increased oxygen off-loading at the tissue level. Author (GRA)

N76-31902# School of Aerospace Medicine, Brooks AFB, Tex.
THE TONE-COUNT AUDIOMETRIC COMPUTER Progress Report, Jan. 1973 - Dec. 1974
Charles R. Meyer, Harrell C. Sutherland, Jr., and Francis A. Brogan Dec. 1975 35 p refs
(AF Proj. 7996)
(AD-A022448; SAM-TR-75-50) Avail: NTIS CSCL 06/5

This paper describes a means of implementing a modified Hughson-Westlake procedure in automated audiometry using a small audiometric computer and a tone-counting technique. The detailed description of the audiometric computer includes its operation manual, programmed flow chart, and circuit schematics. Author (GRA)

N76-31903# School of Aerospace Medicine, Brooks AFB, Tex.
RETINAL CHANGES INDUCED BY HEAVY PARTICLES: A NEW THERAPY MODALITY Interim Report, Jan. - Dec. 1973
David M. Hunter, Charles H. Bonney, John E. Pickering, and Jerome H. Krupp Nov. 1975 15 p refs
(AF Proj. 1921)
(AD-A022449; SAM-TR-75-36; SAM-Review-6-75) Avail: NTIS CSCL 06/5

The effects of accelerated oxygen nuclei upon the retina of a nonhuman primate have been investigated. This simulated deep space radiation affords the possibility of delivering great quantities of energy (at a predetermined depth) within the eye, while but minimally irradiating interposing tissues. When compared with the clinical results following the use of cobalt plaques the oxygen ion has demonstrated a significant compression of both time and dose in achieving the same degree of tissue effect. Therefore, the possibility obtains for a greater local irradiation of intraocular neoplasta with a sharp reduction of radiation damage to surrounding non-neoplastic ocular tissues. GRA

N76-31904# Vermont Univ., Burlington. Dept. of Pathology.
ANALYSIS AND MEASUREMENT OF THE EFFECTS OF MATERIALS ON BLOOD LEUKOCYTES, ERYTHROCYTES AND PLATELETS Annual Report, 1 Dec. 1974 - 30 Nov. 1975
Bert K. Kusserow and Rodney W. Larrow 1 Jan. 1976 97 p refs
(Grant HB-5-2939)
(PB-252720/8; NIH-N01-HR-52939-5) Avail: NTIS HC $5.00 CSCL 06L

Continuing experimental work in refinement and use of an in vivo renal thromboembolus test system for the evaluation of promising and well characterized new biomaterials is described. The renal embolus test system involves the intra-aortic implantation of a cylindrical test ring and the use of the renal vascular bed and parenchyma as a sensitive biologic indicator system of thromboembolic sequellae. A number of promising synthetic materials were evaluated. Severity of implant thrombosis and renal infarct patterns is noted and recorded. Topographical mapping of mural and junctional ring thrombotic deposits is schematically demonstrated. Several materials demonstrate noteworthy resistance to thrombo-embolic complications. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-31905*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PARAMETRIC INVESTIGATION OF RIDE QUALITY RATING SCALES
Thomas K. Dempsey, Glynn D. Coates (Old Dominion Univ.), and Jack D. Leatherwood Sep. 1976 37 p refs
(NASA-TM-X-73946) Avail: NTIS HC $4.00 CSCL 05E

The relative merits of various category scales for the prediction of human discomfort response to vibration and the mathematical relationships that allow for transformations of subjective data from one scale to another scale were determined. A total of 16 category scales were studied and these represented various parametric combinations of polarity, scale type, and number of scalar points. Sixteen subject groups were used and each subject group evaluated its comfort/discomfort to vertical sinusoidal vibration using one of the rating scales. The passenger ride quality apparatus which can expose six subjects simultaneously to predetermined vibrations was utilized. The vibration stimuli were composed of repeats of selected sinusoidal frequencies applied at each of nine peak floor acceleration levels. A higher degree of reliability and discriminability was generally obtained from unipolar continuous type scales containing either seven or nine scalar points as opposed to the other scales investigated. S.M.

N76-31906# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HIGHER ORDER ADAPTIVE TRAINING SYSTEMS Final Report, May 1975 - Feb. 1976
Wallace Feurzeig, George Lukas, and A. W. F. Huggins Feb. 1976 42 p refs
(Contract N61339-75-C-0104)
(AD-A023594; BBN-3220; NAVTRAEQUIPC-75-C-0104-4) Avail: NTIS CSCL 05/9

A computer-based instrument flight simulation system, ORLY, has been developed as the framework for an automated diagnostic and training facility. ORLY-based protocol experiments were designed in which student pilot difficulties shown in the course of carrying out IFR tasks were described and diagnosed by instructor pilots. Case studies of initial instructor protocols are described. Protocol analysis procedures and problems are discussed. GRA

N76-31907# Singer Co., Binghamton, N.Y. Simulation Products Div.
ADVANCED SIMULATION IN UNDERGRADUATE PILOT TRAINING: VISUAL DISPLAY DEVELOPMENT Final Report, Mar. 1971 - Oct. 1975
Lawrence Nass (Farrand Optical Co., Inc., Valhalla, N. Y.), Peter Seats (Thomas Electronics, Inc., Wayne, N. J.), and William B. Albery Dec. 1975 123 p refs
(Contract F33615-71-C-1255)
(AD-A022962; AFHRL-TR-75-59(6)) Avail: NTIS CSCL 05/9

Visual simulation and its application to flying training is in its infancy. The development of the two visual display systems including the infinity optics, support structures, and 36-inch diameter (the world's largest) cathode ray tube described in this report has already produced a worthwhile legacy to the state of the art visual simulation. The development of the visual display systems for the advanced simulator for undergraduate pilot training (ASUPT) is generally described as three separate efforts: (1) in-line infinity optics, or pancake window development, (2) dodecahedron structure development, and (3) cathode ray tube (CRT) development. The genesis of all three of these efforts represents individual contributions to the state of the art. The pancake windows are the largest of their kind ever developed. The simulator for air-to-air combat employs similar windows, structures, and CRTs but the windows and CRTs are scaled-down versions of the ASUPT designs. The ASUPT visual display structures were tested under dynamic conditions on a motion platform in early 1972; the structural integrity of the dodecahedron design was verified. The CRTs represent, perhaps, the most important element of the ASUPT. For it is the remarkable development of these, the world's largest, hand-crafted TV tubes that not only paced the entire progress of the program, but also provided the ASUPT with its 'eyes' and made it the valuable asset that it is today. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-31908*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology Organization.
DESIGN, FABRICATION AND TEST OF A TRACE CONTAMINANT CONTROL SYSTEM
28 Nov. 1975 356 p refs
(Contract NAS1-11526)
(NASA-CR-147860; LMSC-D462467) Avail: NTIS HC $10.50 CSCL 06K

A trace contaminant control system was designed, fabricated, and evaluated to determine suitability of the system concept to future manned spacecraft. Two different models were considered. The load model initially required by the contract was based on

the Space Station Prototype (SSP) general specifications SVSK HS4655, reflecting a change from a 9 man crew to a 6 man crew of the model developed in previous phases of this effort. Trade studies and a system preliminary design were accomplished based on this contaminant load, including computer analyses to define the optimum system configuration in terms of component arrangements, flow rates and component sizing. At the completion of the preliminary design effort a revised contaminant load model was developed for the SSP. Additional analyses were then conducted to define the impact of this new contaminant load model on the system configuration. A full scale foam-core mock-up with the appropriate SSP system interfaces was also fabricated. Author

N76-31909*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology Organization.
DESIGN, FABRICATION, AND TEST OF A TRACE CONTAMINANT CONTROL SYSTEM. APPENDIXES A AND B
28 Nov. 1975 136 p
(Contract NAS1-11526)
(NASA-CR-147861; LMSC-D462467-App-A; LMSC-D462467-App-B) Avail: NTIS HC $6.00 CSCL 06K

Engineering specifications of a trace contaminant control system designed for the Space Station Prototype (SSP) were given. These were divided into two appendices: (1) a list of nonmetallic materials used, and (2) engineering drawings of the overall system, sub-assemblies, and components. Y.J.A.

N76-31910*# Life Systems, Inc., Cleveland, Ohio.
ONE-MAN ELECTROCHEMICAL AIR REVITALIZATION SYSTEM EVALUATION Final Report, 1 Sep. 1975 - 31 Aug. 1976
F. H. Schbert, R. D. Marshall, T. M. Hallick, and R. R. Woods Jul. 1976 67 p refs
(Contract NAS9-14658)
(NASA-CR-147882; LSI-ER-284-4) Avail: NTIS HC$4.50 CSCL 06K

A program to evaluate the performance of a one man capacity, self contained electrochemical air revitalization system was successfully completed. The technology readiness of this concept was demonstrated by characterizing the performance of this one man system over wide ranges in cabin atmospheric conditions. The electrochemical air revitalization system consists of a water vapor electrolysis module to generate oxygen from water vapor in the cabin air, and an electrochemical depolarized carbon dioxide concentrator module to remove carbon dioxide from the cabin air. A control/monitor instrumentation package that uses the electrochemical depolarized concentrator module power generated to partially offset the water vapor electrolysis module power requirements and various structural fluid routing components are also part of the system. The system was designed to meet the one man metabolic oxygen generation and carbon dioxide removal requirements, thereby controlling cabin partial pressure of oxygen at 22 kN/sq m and cabin pressure of carbon dioxide at 400 N/sq m over a wide range in cabin air relative humidity conditions. Author

N76-31911# Arizona State Univ., Tempe.
VISUAL SCANNING: COMPARISONS BETWEEN STUDENT AND INSTRUCTOR PILOTS Final Report
Joseph DeMaio, Stanley Parkinson, Barry Leshowitz, John Crosby, and Jack A. Thorpe Jun. 1976 34 p refs
(AF Proj. 2313)
(AD-A023634; AFHRL-TR-76-10) Avail: NTIS CSCL 06/16

The performance of instructor pilots and student pilots was compared in two visual scanning tasks. In the first task both groups were shown slides of T-37 instrument displays. Some slides contained a significant deviation from a pre-determined straight and level course, and the task was to detect the error as quickly as possible. Instructor pilots detected errors faster and with greater accuracy than student pilots, thus providing evidence for the validity of the procedures employed. However, contrary to the concept of a fixed cross-check, student pilots showed a greater tendency to employ a systematic search pattern than did instructor pilots. This result suggests that rather than using a rigid scanning pattern, instructor pilots, by virtue of their additional flight experience, use a flexible scanning strategy which allows them to emphasize important or difficult aspects of the display. In the second experiment the attention diagnostic method task was employed to determine if the experience in visual scanning obtained in the flight situation would transfer to a novel scanning task. In the first session there were no differences in response latency between instructor pilots, student pilots, and a group of university students. Instructor pilots, however, showed a significant linear decrease in latency over the course of eight sessions while this trend was absent in the other two groups. This suggests that instructor pilots learn to attend to critical features more efficiently than do individuals with little or no flight experience. The results of the present experiments recommend the use of a variety of scanning tasks in the UPT program to facilitate the more rapid development of adaptive scanning strategies. Author (GRA)

N76-31912# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE CLOSED-LOOP PERFORMANCE AND TRACKING STABILITY OF A DIRECT SIDE FORCE CONTROLLER M.S. Thesis
Robert A. Lancaster, Jr. Jan. 1975 157 p refs
(AD-A022863; GAE/MC/75D-9) Avail: NTIS CSCL 05/8

A closed-loop analysis was performed to determine the desirability and effectiveness of using direct side force control as a means of achieving lateral trajectory control in accomplishing a given tracking task. The specific task investigated was one of an aircraft air-to-ground weapon delivery modeled as a closed-loop compensatory system with the pilot in the loop. The study uses a linear systems approach in conducting a closed-loop analysis of the stability of the tracking solution of a Cornell Aeronautical Laboratory direct side force control system mechanization. Human operator theory is employed in investigating the closed-loop performance of the pilot-vehicle system. GRA

N76-31913# Navy Experimental Diving Unit, Panama City, Fla.
EVALUATION OF THE DRAEGER LAR V PURE OXYGEN SCUBA Final Report, Jul. - Sep. 1975
H. N. Paulsen and Ronald E. Jarvi 8 Oct. 1975 44 p refs
(AD-A022585; NEDU-11-75) Avail: NTIS CSCL 13/10

The Draeger LAR V scuba is a pure oxygen self contained underwater breathing apparatus designed and manufactured in the Federal Republic of Germany. The scuba is completely closed circuit and incorporates a demand type oxygen supply. Gas purification is accomplished by means of a refillable CO2 absorbant canister. The LAR V works on pure oxygen. This evaluation was conducted to determine safe operational capabilities and limitations of the LAR V with respect to training and operational use by Naval Special Warfare Divers. It was found that the LAR V is equal to, and in many respects superior to the U.S. Navy Emerson scuba. The Draeger incorporates many inherent design features which makes it easier to pre/post dive and to maintain than the Emerson closed circuit scuba. GRA

N76-31914# Illinois Univ., Urbana. Coordinated Science Lab.
REAL TIME ADAPTIVE MODELING OF THE HUMAN CONTROLLER WITH APPLICATION TO MAN-COMPUTER INTERACTION
Kenneth Dean Enstrom Jan. 1976 66 p refs
(Contracts DAAB07-72-C-0259; F33615-73-C-1238)
(AD-A023589; R-715; UILU-ENG-76-2203) Avail: NTIS CSCL 09/2

When a human and computer are joined forming a human-computer system, the two decision-makers must work together if the human's workload is to be reduced and overall system performance maintained or improved. Independent actions by each decision maker could prove to be counterproductive. This thesis proposes that cooperation between decision makers can be fostered by using the computer to monitor the actions of the human. Then, the human can act freely, and the computer will use decision policies that do not conflict with the human's current actions, but adapt to them. GRA

N76-31915# School of Aerospace Medicine, Brooks AFB, Tex.
A PROPOSED EMERGENCY PASSENGER-OXYGEN SYSTEM FOR KC-135 AIRCRAFT: AN EVALUATION Interim Report, Sep. 1974 - Apr. 1975
Thomas R. Morgan Dec. 1975 10 p
(AD-A023447; SAM-TR-75-49) Avail: NTIS CSCL 06/11

An emergency passenger-oxygen system for KC-135 aircraft was evaluated in four decompression tests to a simulated cabin altitude of 40,000 feet (12,192 m). The system, an MD-1 (high pressure) oxygen storage assembly coupled to a CRU-78 standard emergency oxygen mask, provided adequate oxygenation of all subjects throughout the tests. The brass nipple released as a consequence of MD-1 activation showed a tendency to later lodge in the oxygen mask hose. A modification eliminating this possibility and observations upon the system's expected effectiveness are discussed. GRA

N76-31916# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
EXHALATION VALVE LEAKAGE TEST Respirator Test Procedure Report
Nancy J. McGinnis Feb. 1976 24 p refs Sponsored by HEW
(PB-252692/9; NIOSH/JC/R-005) Avail: NTIS HC $3.50 CSCL 06K

A procedure is described to enable the reader to perform exhalation valve leakage tests on respirators as required by Title 30 CFR, Part 11. The steady state leakage rate of the exhalation valve is measured in milliliters per unit time and on the positive pressure side of the exhalation valve. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-31917 Brigham Young Univ., Provo, Utah.
A CONTINUOUS TONE COMPUTER GRAPHIC DISPLAY SYSTEM FOR THREE DIMENSIONAL SOLID FINITE ELEMENT MODELS Ph.D. Thesis
Michael Byron Stephenson 1976 150 p
Avail: Univ. Microfilms Order No. 76-18352

The design goals of displaying large three dimensional finite element models as continuous tone color photoimages and of clipping and capping the model on any arbitrary plane were achieved by use of three FORTRAN computer programs. The first program reduces the hexahedron element data from the finite element analysis to potentially visible surfaces using hash or scatter storage tables to suppress interior nodes and polygons. This program also provides for clipping or division of the model along an arbitrary plane. The polygons on the plane are developed so that the model retains its solid appearance when displayed. The second program provides for model manipulation, color definition, scope selection, hidden surface removal, and display. The model may also be deformed by displacements and shaded with color fringes representing various levels of stress or strain. For very large problems, the picture definition is written on disk and later displayed using the third program. Dissert. Abstr.

N76-31918 North Carolina Univ., Chapel Hill.
TEXT SEARCHING AND PATTERN RECOGNITION OF CHEMICAL SPECTROSCOPIC DATA Ph.D. Thesis
Hugh Boyd Woodruff 1975 175 p
Avail: Univ. Microfilms Order No. 76-20090

Methods of computerized data interpretation (search and compare techniques and pattern recognition techniques) are examined with regard to chemical spectroscopic data, especially infrared data. The text-oriented search systems discussed are general in nature, at the expense of a small amount of speed. The text searching algorithm is applied to both infrared and mass spectral data bases. In addition, the ability to systematically analyze a data set for encoding errors by using text searching is demonstrated. Chemical pattern recognition is a process by which common characteristics of spectra are empirically determined from a relatively small set of known spectra. The relationships developed in this manner are then used to predict the presence or absence of these same characteristics in unknown spectra. For example, by analyzing a set of spectra known to be of carboxylic acids, a pattern recognition technique may be employed to develop a discriminant function, the sole purpose of which is to predict whether or not an unknown spectrum is of an acid. Dissert. Abstr.

N76-31919*# Aeronutronic Ford Corp., Houston, Tex. Space Information Systems Operation.
ONLINE MASS STORAGE SYSTEM DETAILED REQUIREMENTS DOCUMENT
2 Jul. 1976 76 p
(Contract NAS9-15014)
(NASA-CR-147877; JSC-10084) Avail: NTIS HC $5.00 CSCL 09B

The requirements for an online high density magnetic tape data storage system that can be implemented in a multipurpose, multihost environment is set forth. The objective of the mass storage system is to provide a facility for the compact storage of large quantities of data and to make this data accessible to computer systems with minimum operator handling. The results of a market survey and analysis of candidate vendor who presently market high density tape data storage systems are included. S.M.

N76-31920# Royal Aircraft Establishment, Farnborough (England).
FURTHER PERFORMANCE STUDIES ON THE ICL 1904A AND AN EARLY STUDY ON THE ICL 1906S
Jeanne M. Janicka Dec. 1975 34 p refs
(RAE-TM-Math-7503; BR50641) Avail: NTIS HC $4.00

A complete system performance study on the ICL 1904A computer at RAE is presented followed by an initial study on the ICL 1906S. Values are compared that have a bearing on running programs such as the different program mill times (measures of processor utilization), core allocations and number of transfers to and from disc due to swapping programs in and out of core. ESA

N76-31921# Stanford Research Inst., Menlo Park, Calif. Augmentation Research Center.
KNOWLEDGE WORKSHOP DEVELOPMENT Final Report
Douglas C. Englebart 30 Jan. 1976 187 p refs
(Contract F30602-72-C-0313; SRI Proj. 1868)
(AD-A022997; SRI-ARC-22133; RADC-TR-75-304) Avail: NTIS CSCL 09/2

The oNLine System, Version 8 (NLS-8) developed at the Augmentation Research Center (ARC) was brought to prototype operation. Improvement in fundamental design continued, but new attention was given to applications and technology transfers. Strategies included an effort to involve more and more users outside ARC, establishment of experts in NLS within user organizations, a training program, an online query system to inform users about NLS, revision of the command language and operation of Network Information Center. New developments include a simple calculator subsystem, multi-host journal system, a variety of options to tailor the system to different working conditions, file access controls, and a control meta language to

make user interface writing easier and more flexible. ARC developed a microprocessor-device, the Lineprocessor, to enhance inexpensive displays for use with two-dimensional display NLS and reduce communication cost. ARC made NLS available on a subscription basis through an information utility with its own computer. GRA

N76-31922# Texas Univ., Austin. Electronics Research Center.
ANALYSIS OF VIRTUAL MEMORY IMPLEMENTATIONS
Lionel S. White, Jr. and T. A. Welch 1 Jul. 1975 124 p refs
(Contract F44620-71-C-0091; AF Proj. 6813; AF Proj. 4751)
(AD-A023116; TR-174; AFOSR-76-0190TR) Avail: NTIS CSCL 09/2

Semiconductor memory components provide opportunities for new computer memory structures due to two advantages they offer over core memories: (1) Logic can be integrated into the memory structures, and (2) small blocks of memory can be accessed independently for improved access flexibility. This research proposes using these properties to achieve a more efficient implementation of a virtual memory system. The proposed system uses novel semiconductor memory chips to integrate the address-mapping function and the data-multiplexing function into the memory circuits, with consequent saving of external overhead circuitry. This proposed system is compared in detail with a conventional implementation of a virtual memory system, showing cost and performance figures for a variety of system configurations. The proposed system is shown to give superior results in smaller memories or in high-performance memories. GRA

N76-31923# Illinois Univ., Urbana. Coordinated Science Lab.
PERFORMANCE EVALUATION OF A HIGHLY CONCURRENT COMPUTER BY DETERMINISTIC SIMULATION M.S. Thesis
Balasubramanian Kumar Feb. 1976 208 p refs
(Contract DAAB07-72-C-0259)
(AD-A023629; R-717; UILU-ENG-76-2205) Avail: NTIS CSCL 09/2

Simulation is presented as a practical technique for performance evaluation of alternative configurations of a complex, highly concurrent computer system. A technique is described for constructing a detailed, deterministic model of the system. In the model, a control stream replaces the instruction and data streams of the real system. Simulation of the system model yields the timing and resource usage statistics needed for performance evaluation, without the necessity of performing the actual system computation. As an example, the implementation of a simulator of a model of the CPU-memory subsystem of the IBM 360/91 is described. The results of evaluating some alternative system designs are discussed. It appears that many of the sophisticated architectural features of the IBM 360/91 CPU would be of little value if high-speed (cache) memory is used, as in the 360/195. Author (GRA)

N76-31924# Naval Ship Research and Development Center, Bethesda, Md.
THE LINEAR EQUATION SOLUTION CAPABILITY OF THREE SUBROUTINE LIBRARIES AVAILABLE AT DTNSRDC
Donald A. Gignac Jan. 1976 23 p refs
(SR0140301)
(AD-A022711; DTNSRDC-76-0023) Avail: NTIS CSCL 12/1

At present there is a wealth of FORTRAN subroutines for coping with the solution of a system of simultaneous linear equations, AX=B. Many of these FORTRAN subroutines are in the IMSL, MSL, and ARL libraries for the CDC 6000 series of computers. The purpose of this report is to help the user make intelligent use of these subroutines. Author (GRA)

N76-31925# Science Applications, Inc., Arlington, Va.
REPORT OF THE ARPA STUDY GROUP ON ADVANCED MEMORY CONCEPTS Final Report, 1 Oct. 1974 - 30 Apr. 1975
E. R. Berlekamp, R. L. Garwin, D. E. Knuth, J. Lederberg, R. A. Leibler, C. Levinthal, J. Rajchman, R. Madden, and V. A. Vyssotsky Feb. 1976 60 p
(Contract F30602-75-C-0098; ARPA Order 2886)
(AD-A021274; SAI-75-631-WA; RADC-TR-76-28) Avail: NTIS CSCL 09/2

Following a brief overview of short-term industrial trends, this report highlights four important research areas which should be prominently included in the ARPA program in Advanced Memory Concepts. Listed in the order of the immediacy of their applicability, these are: (1) innovative technology, (2) architecture, software and theory, (3) materials sciences, including solid state properties of organics, and (4) neurosciences. The final section of this report contains recommendations on how the Advanced Memory Concepts program should be managed. GRA

N76-31926# Pennsylvania State Univ., University Park. Applied Research Lab.
FREQUENCY DOMAIN ADAPTIVE DECOUPLING IN MULTIPLE OUTPUT ARRAY PROCESSORS Ph.D. Thesis
Charles R. Zentner 16 Sep. 1975 159 p refs
(Contract N00017-73-C-1418)
(AD-A023137; TM-75-223) Avail: NTIS CSCL 09/2

This research is concerned with reducing the deleterious effects of undesired signals which are received through the side-lobes of an array in a multiple output array processor. Two forms of beam decoupling systems are suggested. The first is a non-iterative form which, in general, requires a matrix inversion of a power spectral density matrix and the second more useful form is an adaptive algorithm that avoids the direct matrix and the attendant computational requirements of this inversion. This iterative algorithm operates in the frequency domain and in real time to reduce the mean square coupling between fixed adjacent preformed beams. A discrete frequency domain approach is used to avoid time-delay networks which would be needed in a time domain decoupling system. In addition, a frequency domain system offers frequency selectivity in that, at each discrete frequency, beam decoupling can be effected. The beamformer relationship for a multiple output linear beamformer is developed in both the frequency domain and the time domain. These relationships are derived in matrix form. Several relationships for decoupled array processors are also derived in matrix form. These relationships result in diagonal forms of output or input-output power spectral density matrices for decoupled systems. The theoretical development of non-iterative decoupling processors is given. GRA

N76-31927# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SORTING ON A MESH-CONNECTED PARALLEL COMPUTER Interim Report
C. D. Thompson and H. T. Kung Mar. 1976 29 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255; NR Proj. 044-422)
(AD-A022808) Avail: NTIS CSCL 09/2

Two algorithms are presented for sorting M to the 2nd power elements on an nxn mesh-connected processor array that require O(n) routing and comparison steps. The best previous algorithm takes time O(n log n). The algorithms of this paper are shown to be optimal in time within small constant factors. Extensions to higher-dimensional mesh-connected processor arrays are also given. Author (GRA)

N76-31928# American Hydrotherm Corp., New York.
SIMULATION AND DESIGN OF A DIGITAL DATA COMPRESSOR M.S. Thesis. Final Report
John A. Pezzano Kirtland AFB, N. Mex. AFWL Feb. 1976 78 p refs
(AD-A022774; AFWL-TR-75-143) Avail: NTIS CSCL 09/2

The memory required to store the output from analog to digital converters is a problem at the Air Force WEAPONS Laboratory because of the volume of information that needs to be saved. To reduce the memory requirements, a digital data compression technique was developed. The algorithm used, its simulation on a computer, and a hardware design based on it are discussed in this report. The algorithm is based on amplitude and slope differences from successive points from an analog to digital converter. The computer simulation showed that memory requirements could be reduced by as much as ninety percent using this algorithm on transient signals. The hardware design enables further testing and evaluation with actual signals from field tests. Author (GRA)

N76-31929# Computer Corp. of America, Cambridge, Mass.
DATACOMPUTER PROJECT Semiannual Technical Report, 1 Jul. - 31 Dec. 1975
31 Jan. 1976 54 p
(Contract MDA903-74-C-0225; ARPA Order 2687)
(AD-A022859) Avail: NTIS CSCL 09/2

This report describes our work on the Datacomputer system from July 1, 1975 to December 31, 1975. Work during the reporting period falls into two main categories: installation and operation of Datacomputer Version 1, the first full service version of the Datacomputer; and preparation for the next version, which is to incorporate an Ampex Terabit Memory System. Parallel operation of Version 0/11 continued into this period, and various other activities received attention as will be reported. GRA

N76-31930# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Computer and Information Sciences.
INITIAL STRUCTURED SPECIFICATIONS FOR AN UNCOMPROMISABLE COMPUTER SECURITY SYSTEM Final Report
K. G. Walter, W. F. Ogden, J. M. Gilligan, D. D. Schaeffer, and S. I. Schaen Jul. 1975 195 p
(Contract F19628-73-C-0185; AF Proj. 5550)
(AD-A022490; ESD-TR-75-82) Avail: NTIS CSCL 09/2

This report comprises a high level design for a Security Kernel of an operating system which is currently being investigated by the Air Force. This operating system will provide a sophisticated time-sharing mode of operation with a large shared-file environment to a user community comprised of individuals of various clearances. The specifications of the Security Kernel are developed through a series of successively more complex models which are used to specify the system in increasing detail. The first specification defines in general what it means to say that a system is uncompromisable or that there can be no unauthorized disclosure of information. Subsequent models introduce directory structure, interprocess communication, file and process attributes, and other system functions. Using this approach, we can discuss various design issues related to security in an orderly and straightforward manner. GRA

N76-31931# Interagency Committee on Automatic Data Processing, Washington, D. C.
PROCEEDINGS OF THE INTERAGENCY AUTOMATED DATA PROCESSING PLANNING CONFERENCE Final Report
Mar. 1976 260 p refs Conf. held at Warrenton, Va., 22-24 Feb. 1976
(PB-252943/6) Avail: NTIS HC $9.00 CSCL 09B

Contents: centralization of ADP management; executive legislative relationships; management information systems; personnel management; public/private sector responsibilities; and sharing. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-31932*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONCATENATED CODING SYSTEMS EMPLOYING A UNIT-MEMORY CONVOLUTIONAL CODE AND A BYTE-ORIENTED DECODING ALGORITHM
Lin-nan Lee (LINKABIT Corp., San Diego, Calif.) 12 Jul. 1976 35 p refs
(Grant NsG-5025)
(NASA-CR-147974; EE-769) Avail: NTIS HC $4.00 CSCL 09B

Concatenated coding systems utilizing a convolutional code as the inner code and a Reed-Solomon code as the outer code are considered. In order to obtain very reliable communications over a very noisy channel with relatively small coding complexity, it is proposed to concatenate a byte oriented unit memory convolutional code with an RS outer code whose symbol size is one byte. It is further proposed to utilize a real time minimal byte error probability decoding algorithm, together with feedback from the outer decoder, in the decoder for the inner convolutional code. The performance of the proposed concatenated coding system is studied, and the improvement over conventional concatenated systems due to each additional feature is isolated. Author

N76-31933*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
EIGENVALUE EXTRACTION IN NASTRAN BY THE TRIDIAGONAL REDUCTION (FEER) METHOD: REAL EIGENVALUE ANALYSIS Final Report
Malcolm Newman and Paul F. Flanagan Washington NASA Aug. 1976 65 p refs
(NAS1-13849)
(NASA-CR-2731) Avail: NTIS HC $4.50 CSCL 09B

The development of the tridiagonal reduction method and its implementation in NASTRAN are described for real eigenvalue analysis as typified by structural vibration and buckling problems. This method is an automatic matrix reduction scheme whereby the eigensolutions in the neighborhood of a specified point in the eigenspectrum can be accurately extracted from a tridiagonal eigenvalue problem whose order is much lower than that of the full problem. The process is effected without orbitrary lumping of masses or other physical quantities at selected node points and thus avoids one of the basic weaknesses of other techniques. Author

N76-31934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECURSIVE PARTITIONED INVERSION OF LARGE (1500 x 1500) SYMMETRIC MATRICES
Barbara H. Putney, Joseph E. Brownd, and Richard A. Gomez Jul. 1976 52 p refs Submitted for publication
(NASA-TM-X-71181; X-921-76-160) Avail: NTIS HC $4.50 CSCL 09B

A recursive algorithm was designed to invert large, dense, symmetric, positive definite matrices using small amounts of computer core, i.e., a small fraction of the core needed to store the complete matrix. The described algorithm is a generalized Gaussian elimination technique. Other algorithms are also discussed for the Cholesky decomposition and step inversion techniques. The purpose of the inversion algorithm is to solve large linear systems of normal equations generated by working geodetic problems. The algorithm was incorporated into a computer program called SOLVE. In the past the SOLVE program has been used in obtaining solutions published as the Goddard earth models. Author

N76-31935*# Technology, Inc., Houston, Tex. Life Sciences Div.
AN AUTOMATED SYSTEM FOR PULMONARY FUNCTION TESTING
Donald G. Mauldin 21 Nov. 1974 120 p
(Contract NAS9-13291)
(NASA-CR-147869) Avail: NTIS HC $5.50 CSCL 09B

An experiment to quantitate pulmonary function was accepted for the space shuttle concept verification test. The single breath maneuver and the nitrogen washout are combined to reduce the test time. Parameters are defined from the forced vital capacity maneuvers. A spirometer measures the breath volume and a magnetic section mass spectrometer provides definition of gas composition. Mass spectrometer and spirometer data are analyzed by a PDP-81 digital computer. S.M.

N76-31936*# Technology, Inc., Houston, Tex. Life Sciences Div.
EMGAN: A COMPUTER PROGRAM FOR TIME AND FREQUENCY DOMAIN REDUCTION OF ELECTROMYOGRAPHIC DATA
William N. Hursta 5 Sep. 1975 165 p refs
(Contract NAS9-13291)
(NASA-CR-147878) Avail: NTIS HC $6.75 CSCL 09B

An experiment in electromyography utilizing surface electrode techniques was developed for the Apollo-Soyuz test project. This report describes the computer program, EMGAN, which was written to provide first order data reduction for the experiment. EMG signals are produced by the membrane depolarization of

muscle fibers during a muscle contraction. Surface electrodes detect a spatially summated signal from a large number of muscle fibers commonly called an interference pattern. An interference pattern is usually so complex that analysis through signal morphology is extremely difficult if not impossible. It has become common to process EMG interference patterns in the frequency domain. Muscle fatigue and certain myopathic conditions are recognized through changes in muscle frequency spectra. Author

N76-31937# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
I/O SYSTEM IN BASIC LANGUAGE FOR THE HP2116B COMPUTER (IOB5) [SISTEMA DI INGRESSO USCITA IN LINGUAGGIO BASIC PER IL CALCOLATORE HP2116B (IOB5)]
P. Cerulli-Irelli Sep. 1975 20 p refs In ITALIAN
(LPS-75-33) Avail: NTIS HC $3.50

Summaries and updates are given for previous reports on programs and user manuals of the HP2166B computer. The overall features and construction of the input/output system in BASIC language for the interface of central processing unit and peripheral units are described. ESA

N76-31938# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
ADJUSTMENT BY THE PRINCIPLE OF MINIMAL MAXIMUM ERROR [AUSGLEICHUNG IM SINNE MINIMALER MAXIMALFEHLER]
Gerhard Heindl and Ewald Reinhart Bayerische Akad. der Wiss. 1976 37 p refs In GERMAN; ENGLISH summary
(Ser-A-84; ISBN-3-7696-8169-X) Avail: NTIS HC $4.00

A method is proposed for computing a unique best estimate for a set of unknown parameters from observations and known bounds on the observation errors. Using the simplex algorithm of the theory of linear programming, the method leads to an estimate minimizing the maximal possible errors of its components. Several other desirable properties of this best estimate are shown. Problems with weighted quantities and problems in which best estimates for vectors depending on the unknown parameters are searched for can be handled by slight extensions of the described method. As an example, the best estimate for a set of coordinates of stations of an EDM network is computed.
Author (ESA)

N76-31939# Royal Aircraft Establishment, Farnborough (England).
A DESCRIPTION OF THE PROGRAMS USED FOR BUDGETARY CONTROL OF COMPUTER SERVICE WORK AT RAE FARNBOROUGH
D. Morgan Feb. 1976 49 p refs
(RAE-TR-76025; BR52036) Avail: NTIS HC $4.00

The programs are described, starting with the data base, and then dealing with the main and subsidiary programs. Basic spending data is obtained from a suite of accounting programs.
ESA

N76-31940# RAND Corp., Santa Monica, Calif.
THE ECSS 2 LANGUAGE FOR SIMULATING COMPUTER SYSTEMS Interim Report
Donald W. Kosy Dec. 1975 487 p refs
(Contract GS-00C-50020)
(AD-A021262; R-1895-GSA) Avail: NTIS CSCL 09/2

ECSS 2 is a specialized programming language for constructing simulation models of computer-based systems. It provides a rich variety of statements and data-structures for describing common computer hardware configurations, software operations, and workload characteristics in a natural and straightforward notation. It has been implemented as an extension of the general-purpose simulation language SIMSCRIPT 2, and that language is included as a subset. This report is a tutorial manual describing ECSS 2 and how it is used to build simulation models. It is divided into four parts. Part I contains a brief introductory chapter discussing the use of simulation in analyzing computer systems and some of the key features of ECSS 2 that assist in that process. Parts II, III, and IV describe the language constructs in successively greater levels of detail. GRA

N76-31941# Softech, Inc., Waltham, Mass.
A STUDY OF HIGH LEVEL LANGUAGE FEATURES. VOLUME 2: DETAILED LANGUAGE FEATURES ANALYSIS Final Report, May 1975 - Jan. 1976
John B. Goodenough and Lawrence H. Shafer Feb. 1976 390 p refs
(Contract DAAB07-75-C-0373; DA Proj. 1S7-62701-AH-92)
(AD-A021207; Rept-1021-10-Vol-2; ECOM-75-0373-F-Vol-2)
Avail: NTIS CSCL 09/2

The two volumes of this report present a comprehensive survey and analysis of high level programming language features, together with a selection of features needed to program Army tactical computer-based systems. This volume of the report contains detailed analyses of the strengths and weaknesses of language features found in a wide variety of programming languages. Although not all features are analyzed with equal thoroughness and although certain completeness and consistency checks remain to be done, the analyses begin to capture what has been learned about the merits and deficiencies of existing language features. This information can be used to help guide the selection or design of a language for programming tactical or other kinds of systems. GRA

N76-31942# Softech, Inc., Waltham, Mass.
A STUDY OF HIGH LEVEL LANGUAGE FEATURES, VOLUME 1 Final Report, May 1975 - Jan. 1976
John B. Goodenough and Lawrence H. Shafer Feb. 1976 150 p refs
(Contract DAAB07-75-C-0373; DA Proj. 1S7-62701-AH-92)
(AD-A021206; Rept-1021-10-Vol-1; ECOM-75-0375-F-Vol-1)
Avail: NTIS CSCL 09/2

The two volumes of this report present a comprehensive survey and analysis of high level programming language features, together with a selection of features needed to program Army tactical computer-based systems. The report is devoted mainly to detailed analyses of the strengths and weaknesses of language features supported by a wide variety of general purpose languages. This volume of the report describes the approach taken to this study, and in an Appendix, provides an index to the detailed feature analyses contained in Volume 2. Two other Appendices contain surveys of language requirements for process handling and input/output. A fourth Appendix documents the need for certain application-dependent language features, based on a study of actual tactical system specifications and programs. GRA

N76-31943# Science Applications, Inc., La Jolla, Calif.
FSCATT: ANGULAR DEPENDENCE AND FILTER OPTIONS Final Report, 1 Oct. 1973 - 15 Jun. 1974
R. H. Fisher and W. Simmons Aberdeen Proving Ground, Md. BRL Mar. 1976 238 p refs
(Contract DAAD05-75-C-0724; DA Proj. 1W1-62113-A-659)
(AD-A023188; SAI-75-500-LJ; BRL-CR-290) Avail: NTIS CSCL 09/2

The FSCATT code was modified to allow the spectral characteristics and intensity of the source to vary as a function of the angle of incidence. In addition, options to allow pre-filtering of the incident spectra and display and storage of spectral information between material layers are provided. The input routines to the code have been completely rewritten to allow for a free-form input format. The input routines now provide self-consistency checks and diagnostics for the user's edification. GRA

N76-31944# Army Materiel Command, Alexandria, Va.
SPECIAL SYMPOSIUM ON ADVANCED HYBRID COMPUTING Final Report
Aldric Saucier Jul. 1975 192 p refs Symp. held in San Francisco, 23-24 July, 1975
(AD-A022660) Avail: NTIS CSCL 09/2

The symposium focuses on several recent technological advancements on both hardware and software, which makes it possible to develop an advanced hybrid computer system (AHCS). These advances, which include highly reliable, low-cost solid-state switching devices, advanced communication techniques and high-level hybrid programming languages, provide the AHCS with automatic patching and scaling, remote terminal access for time-slicing the system and complete programmability in a high-level, CSSL-type language. As a result, this system will be

easily programmable by the non-hybrid-oriented user, yet still maintain the 30:1 cost and speed advantages over pure-digital systems for solving dynamic problems. Although designed as a stand-alone system, the AHCS could easily be linked to any large-scale digital computer to allow the access of hybrid computer programs or routines for use in digital programs. Even if the next generation of digital machines is ten times faster than today's, the AHCS will still be two to three orders of magnitude faster for dynamic simulation problems, and will market for less than one-tenth the cost. GRA

N76-31945# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
MATCHAR: A COMPUTER PROGRAM FOR ESTIMATING CHARACTER ERROR RATE
Rodger E. Poore Dec. 1975 53 p ref
(Contract N00014-76-C-0001)
(AD-A022966; CRC-289) Avail: NTIS CSCL 09/2

A computer program for estimating character error rate by comparing send and receive character streams is described and evaluated. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N76-31946* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL PLUS ANALOG OUTPUT ENCODER Patent
Ralph S. Hafle, inventor (to NASA) (Baldwin Electronics, Inc.) Issued 24 Aug. 1976 30 p Filed 14 Jun. 1972 Sponsored by NASA
(NASA-Case-GSC-12115-1; US-Patent-3,976,997; US-Patent-Appl-SN-262596; US-Patent-Class-340-347SY) Avail: US Patent Office CSCL 09B

The disclosed encoder is adapted to produce both digital and analog output signals corresponding to the angular position of a rotary shaft, or the position of any other movable member. The digital signals comprise a series of binary signals constituting a multidigit code word which defines the angular position of the shaft with a degree of resolution which depends upon the number of digits in the code word. The basic binary signals are produced by photocells actuated by a series of binary tracks on a code disc or member. The analog signals are in the form of a series of ramp signals which are related in length to the least significant bit of the digital code word. The analog signals are derived from sine and cosine tracks on the code disc.
Official Gazette of the U.S. Patent Office

N76-31947# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands). Div. Scientific Services.
DATA COMMUNICATION AT VARIOUS SPEEDS WITH A CYBER-72 VIA A MODCOMP MINICOMPUTER AS DATA CONCENTRATOR
J. J. Niewold and U. PosthumadeBoer 19 Sep. 1975 21 p refs Presented at the 20th European Control Data Users Conf., Budapest, 23-25 Sep. 1975
(NLR-MP-75034-U) Avail: NTIS HC $3.50

The desirable characteristics of the high speed data communication link between a CYBER-72 central computing facility and a MODCOMP data concentrator are described for a three level computer network. These characteristics are compared with available possibilities for data communication for this link. For the communication hard and software of the CYBER one high speed protocol is available, but this has no multi site/multi station addressing capability. The MODCOMP has no restrictions for a protocol but for a constraint to the capability of direct memory processing. To fulfil all desired capabilities, a user programmable communication device is required. Author (ESA)

N76-31948# National Physical Lab., Teddington (England). Div. of Computer Science.
FURTHER SIMULATION EXPERIMENTS ON ADAPTIVE ROUTING USING LOCALLY AVAILABLE PARAMETERS
W. L. Price Dec. 1975 19 p refs Sponsored by Computer Systems and Electron. Requirements Board
(NPL-COM-81) Avail: NTIS HC $3.50

An account is given of the studies of adaptive routing in store and forward communication networks carried out in connection with the NPL simulation work program. It is shown that previous assessments of routing doctrines have been made on the basis of ultimate performance under heavy loads. A comparison is made between various doctrines on the basis of ability to handle extra imposed local streams of traffic between single sources and destinations. It is apparent that the best doctrines are those which achieve a splitting of loads between alternative routes. Author (ESA)

N76-31949# Polytechnic of Central London (England).
VARIABLE TOPOLOGY MULTICOMPUTER SYSTEM Final Report
Yakup Paker Nov. 1975 63 p refs
(Contract DA-ERO-124-74-G0079; DA Proj. 1T1-61102-B-31E)
(AD-A022175) Avail: NTIS CSCL 09/2

The main features of a proposed variable topology multicomputer (VTM) system have been established. The communication links between the node computers of the network can be designed to allow the combination of both packet and circuit switching techniques. Design aspects of the inter-computer message handler are discussed in detail. Various analytical models of VTM structures have been investigated and the results of a digital simulation of the performance of a single node computer are presented. Author (GRA)

N76-31950# Mitre Corp., Bedford, Mass.
SECURE COMPUTER SYSTEM: UNIFIED EXPOSITION AND MULTICS INTERPRETATION
D. Bell and Leonard J. LaPadula Mar. 1976 133 p refs
(Contract F19628-75-C-0001; AF Proj. 522B)
(AD-A023588; MTR-2997-Rev-1; ESD-TR-75-306) Avail: NTIS CSCL 09/2

A unified narrative exposition of the ESD/MITRE computer security model is presented. A suggestive interpretation of the model in the context of Multics and a discussion of several other important topics (such as communications paths, sabotage and integrity) conclude the report. A full, formal presentation of the model is included in the Appendix. GRA

N76-31951# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AUTOMATED MULTIPLE FAULT TEST GENERATION FOR COMBINATIONAL NETWORKS M.S. Thesis
Robert A. Hendrix Mar. 1976 156 p refs
(AD-A023174; GE/EE/76-2) Avail: NTIS CSCL 09/2

This report deals with multiple fault detection in combinational logic networks; the faults considered are those which may be represented by one or more lines stuck at logic value 0 or 1. Some new theorems and rules are presented which aid in the identification of masking faults, and an algorithm is developed which produces multiple fault detection test sets for single-output combinational logic networks. The algorithm uses a path sensitizing technique to generate tests for members of a set of prime faults; any network fault can be represented by a combination of faults from the prime fault set, and a test which detects all combinations of prime faults will detect any single or multiple fault in the network. A modified version of the algorithm is implemented in the FORTRAN computer programming language; the automated version produces test sets which are optimal or near-optimal and usually complete. In the test generation process, certain redundancies are also detected. GRA

N76-31952# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A SIMULATION MODEL OF TSS 8.1 Interim Report, 1 Jul. 1972 - 30 Sep. 1975
Michael F. Bauer and Keki B. Irani Griffiss AFB, N. Y. RADC Feb. 1976 106 p refs
(Contract F30602-73-C-0001; AF Proj. 5581)
(AD-A022668; RADC-TR-76-37) Avail: NTIS CSCL 09/2

The practice of constructing simulation models which can be run on digital computers is a promising methodology for conducting experiments on large scale systems. By using such a model, the analyst can theoretically conduct many experiments which cannot be done on the system being analyzed due to

lack of available time, lack of control over the environment, lack of the resources required to configure the system in the manner appropriate to the experiment, or unwillingness to disrupt normal system operation for purposes of experimentation. This paper describes the design and implementation of such a simulation model for a large-scale computing system. Emphasis is placed on the objectives of the model, the various compromises and assumptions which had to be made in the model itself, the collection of data from the system under test, the implementation of the model in the form of a digital computer simulation, and the effort made to validate the simulation. The discrepancies observed in the validation data are discussed, and further experiments are suggested. Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N76-31953*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Electrical and Systems Engineering.

ANALYSIS AND APPLICATION OF MINIMUM VARIANCE DISCRETE TIME SYSTEM IDENTIFICATION

H. Kaufman and S. Kotob (Computer Sciences Corp., Falls Church, Va.) [1975] 6 p refs

(Grant NGR-33-018-183)

(NASA-CR-147973) Avail: NTIS HC $3.50 CSCL 12B

An on-line minimum variance parameter identifier is developed which embodies both accuracy and computational efficiency. The formulation results in a linear estimation problem with both additive and multiplicative noise. The resulting filter which utilizes both the covariance of the parameter vector itself and the covariance of the error in identification is proven to be mean square convergent and mean square consistent. The MV parameter identification scheme is then used to construct a stable state and parameter estimation algorithm. Author

N76-31954# California Univ., Livermore. Lawrence Livermore Lab.

CHEMICAL DATA ANALYSIS BY PATTERN RECOGNITION

C. F. Bender 13 May 1975 20 p refs Presented at the Conf. on Computer Support of Environ. Sci. and Analysis, Albuquerque, N. Mex., 9-11 Jul. 1975 Sponsored by ERDA

(UCRL-76859; Conf-750706-6) Avail: NTIS HC $4.00

Interactive and iterative use of pattern recognition techniques are presented to solve a number of problems, including a simple chemical example and a complicated production problem.

Author (NSA)

N76-31955# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).

LONG TERM PROGNOSIS FOR SAMPLE PROCESSING AND SAMPLE RECOGNITION. IMAGE PROCESSING BRANCH [LANGZEITPROGNOSE ZUR MUSTERVERARBEITUNG UND MUSTERERKENNUNG. TEILGEBIET BILDVERARBEITUNG]

M. Bohner Bonn DOKZENTBw 1975 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-75-19) Avail: NTIS HC $5.00; DOKZENTBw DM 30

The development of automatic image processing within the next ten years was investigated. A questionnaire for this purpose was compiled and discussed with experts in the fields of information processing and pattern recognition. The replies were used as a basis for the prognosis. Existing bottlenecks in image processing were evaluated, and specifications were derived for hardware, software, and methods necessary in future image processing systems. Special applications for image processing are discussed. ESA

N76-31956# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).

LONG TERM PROGNOSIS FOR PATTERN PROCESSING AND PATTERN RECOGNITION. CHARACTER- AND PATTERN RECOGNITION BRANCH [LANGZEITPROGNOSE ZUR MUSTERVERARBEITUNG UND MUSTERERKENNUNG. TEILGEBIET ZEICHEN- UND MUSTERERKENNUNG]

Joergen Foith, Horst Gudat, Alwin Guedesen, Axel Korn, and Eike Muehlenfeld Bonn DOKZENTBw 1975 92 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-75-19a) Avail: NTIS HC $5.00; DOKZENTBw DM 30

The main part of research and development in pattern recognition is expected in the areas of picture processing, speech recognition, industrial robot systems, and medical diagnosis aids. The problems in character recognition were fully solved for printed characters and for handprinted patterns. In automatic speech recognition a solution without restriction is neither in sight nor necessary. First devices are already for sale for isolated words. Industrial robot systems can be expected in various forms for handling, process control, and fault detection purposes by processing optical, acoustic, and tactile signals. Medical diagnoses in many areas are supported by computer aids. Many stimulations from basic research in biocybernetics as well as from theoretical works in artificial intelligence are feasible for the solution of these problems. Author (ESA)

N76-31957# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IMAGE PROCESSING BY COMPUTER

Guy Hanuise Nov. 1975 38 p refs In FRENCH; ENGLISH summary Report will also be announced as translation

(ONERA-NT-1975-10; FR-ISSN-0078-3781) Avail: NTIS HC $4.00

The important increase of the role of the image, considered as a two-dimensional set of points containing information, brought to light a number of problems on coding before transmission, filtering, image restitution, and information selection. Numerical methods may be used for these various processing stages. The possibilities offered in this field by orthogonal transforms with so called fast calculation algorithm are presented. An analysis of the amount of information contained within an image, and of its reduction with as little loss as possible, leads to the Karhunen Loeve transform, which is optimal in the least squares sense. The clumsiness of the calculations associated with that transformation required the use of orthogonal transforms, easier to handle on a computer, as they are of the fast algorithm type. The properties of the three main transforms (Fourier, Hadamard, Haar) are briefly described. A few simple examples of computer processings are given: influence of the quantification of a numerical hologram on image reconstitution, convolution of two images, matched filtering and pattern recognition, and special properties of the Haar transform. How these results concern the broader field of numerical simulation of physical systems is shown. Author (ESA)

N76-31958# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.

COUPLING AND COUPLING SENSITIVITY IN LINEAR DISCRETE TIME-INVARIANT DYNAMICAL SYSTEMS Final Report, Apr. 1973 - Sep. 1975

E. M. Cliff Sep. 1975 61 p refs

(Grant NSF GK-37401)

(PB-251359/6; VPI-Aero-40; VPI-E-75-22) Avail: NTIS HC $4.50 CSCL 12A

Geometric concepts are used to develop two scalar valued functions that index the level of coupling in discrete, linear, time-invariant systems. The first candidate, based on a subspace formulation, is shown to suffer from a serious flaw: the resultant index is a discontinuous function of the system parameters. A second index, based on reachable sets, produces a more satisfactory result. The function and its derivatives with respect to system parameters are easily evaluated. A FORTRAN 4 computer program to perform the calculations is included. Using this program it is a simple matter to evaluate the level of coupling or the sensitivity of coupling to changes in system parameters.

GRA

N76-31959# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

WHATS IN A LINK: FOUNDATIONS FOR SEMANTIC NETWORKS

W. A. Woods Nov. 1975 76 p refs

(Contracts N00014-75-C-0533; ARPA Order 2904)
(AD-A022584; BBN-3072; AI-38) Avail: NTIS CSCL 05/7

The paper is concerned with the theoretical underpinnings for semantic network representations. It is concerned specifically with understanding the semantics of the semantic network structures themselves, i.e., with what the notations and structures used in a semantic network can mean, and with interpretations of what these links mean that will be logically adequate to the job of representing knowledge. It focuses on several issues: the meaning of 'semantics', the need for explicit understanding of the intended meanings for various types of arcs and links, the need for careful thought in choosing conventions for representing facts as assemblages of arcs and nodes, and several specific difficult problems in knowledge representation - especially problems of relative clauses and quantification. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-31960 Kansas State Univ., Manhattan.
MULTI-DIMENSIONAL RESPONSE MATRIX METHOD Ph.D. Thesis
Goesta Sten-Oerjan Lindahl 1976 295 p
Avail: Univ. Microfilms Order No. 76-17133

Rigorous general response functional equations are derived in two forms. In the first, 'the response matrix source method', interface currents, sources and fluxes are present in the equations, and both fixed source and criticality problems can be solved. In the second, 'the response matrix eigenvalue method', sources are not present, and interface currents are calculated by solving an eigenvalue equation. The latter method is used for criticality computations. The properties of the response matrix equations are explored theoretically as well as numerically. It is found that the spatial Legendre polynomial expansion converges very rapidly although the presence of singularities restricts the convergence rate. Two methods are described for calculating rectangular multigroup response matrices. The first presumes knowledge of one-group response matrices. The second is a semi-analytical method based on diffusion theory. The response matrix method has features that makes it suitable for, among other things, reactor core calculations. Dissert. Abstr.

N76-31961 Montana Univ., Missoula.
CONVERGENCE CRITERIA FOR NONLINEAR SUCCESSIVE DISPLACEMENTS Ph.D. Thesis
Dick Arlen Wood 1976 89 p
Avail: Univ. Microfilms Order No. 76-19443

In 1959 H. M. Lieberstein suggested the iterative scheme known as successive displacements as an improvement to Newton's method for solving nonlinear equations of the type $F(x) = 0$ where F maps a Banach space S into a Banach space Y. When $X = Y = R$ to the N power, Ortega and Rheinboldt call this technique the SOR-Newton technique. Convergence criteria of an uncheckable nature, which requires knowing the root in order to determine whether the sequence of iterates converges to the root, was studied. Theorems concerning convergence of iterative methods from Banach spaces to complete pseudometric spaces were generalized. Checkable convergence criteria were then obtained from the results. Dissert. Abstr.

N76-31962 North Carolina Univ., Chapel Hill.
TESTS FOR OMITTED VARIABLES AND INCORRECT FUNCTIONAL FORM IN REGRESSION ANALYSIS Ph.D. Thesis
Jerry Gilbert Thursby 1975 138 p
Avail: Univ. Microfilms Order No. 76-20080

Testing procedures for the misspecifications of an omitted variable(s) and an incorrect functional form in single equation least squares regression analysis were studied, with emphasis on testing for these misspecifications in the absence of specified alternatives. Three distinct approaches to testing the null hypothesis and its associated alternative for both misspecifications are considered. The first is to test for autocorrelated disturbances. The second is to test for the nonzero disturbances mean which results from these misspecifications. The last is motivated by the incorrect functional form misspecification. The method is a search over a wide range of possible transformations of the dependent and independent variables to find the ones which give the best linear fit. The primary emphasis is a study of the tests grouped under the second approach. Only one test procedure, the Regression Specification Error Test (RESET), has been developed which can be classed under this approach. The power of the RESET procedures is compared to the power of the transformation procedure and the tests for autocorrelation.
Dissert. Abstr.

N76-31963 Utah Univ., Salt Lake City.
STOCHASTIC VISCOELASTIC FINITE ELEMENT ANALYSIS Ph.D. Thesis
Jim Jinn-Sheng Tseng 1976 162 p
Avail: Univ. Microfilms Order No. 76-20748

A procedure to determine the two statistical moments and the time dependent means and covariances of propagation (viscoelastic) type problems is developed. The method is based upon discretizing the time axis following a finite difference method. At each point the analysis is an equilibrium (elastic) finite element solution that has modified modulus and boundary conditions. By using a Taylor series expansion and linear transformation of moments, the first degree approximation of the moments of the displacements and stresses is obtained. An axisymmetric computer program is developed for obtaining the solution. The results of an example problem are presented to demonstrate the accuracy and applicability of the method. Dissert. Abstr.

N76-31964*# General Applied Science Labs., Inc., Westbury, N.Y.
HIGHER-ORDER NUMERICAL METHODS DERIVED FROM THREE-POINT POLYNOMIAL INTERPOLATION Final Report, Apr. 1975 - Apr. 1976
S. G. Rubin and P. K. Khosla Washington NASA Aug. 1976 75 p refs
(Contract NAS1-13885)
(NASA-CR-2735; TR-228) Avail: NTIS HC $4.50 CSCL 12A

Higher-order collocation procedures resulting in tridiagonal matrix systems are derived from polynomial spline interpolation and Hermitian finite-difference discretization. The equations generally apply for both uniform and variable meshes. Hybrid schemes resulting from different polynomial approximations for first and second derivatives lead to the nonuniform mesh extension of the so-called compact or Pade difference techniques. A variety of fourth-order methods are described and this concept is extended to sixth-order. Solutions with these procedures are presented for the similar and non-similar boundary layer equations with and without mass transfer, the Burgers equation, and the incompressible viscous flow in a driven cavity. Finally, the interpolation procedure is used to derive higher-order temporal integration schemes and results are shown for the diffusion equation. Author

N76-31965# Stockholm Univ. (Sweden). Dept. of Meteorology.
ON VERTICAL INTERPOLATION AND TRUNCATION IN CONNEXION WITH USE OF SIGMA SYSTEM MODELS
Hilding Sundqvist Jan. 1976 42 p refs
(Contract OSV3-0262)
(DM-19) Avail: NTIS HC $4.00

The effect of vertical truncation in connection with interpolation of geopotential from standard pressure to sigma levels was examined. It is shown that the hydrostatically related temperature and geopotential fields in the sigma system become inconsistently related with regard to calculation of the pressure force in this system. This inconsistency occurs as a result of vertical truncation around temperature inversions (e.g., the tropopause) above a sloping ground. Numerical examples show that erroneous pressure gradients are introduced which, expressed in equivalent gradient wind, have a magnitude of several m/s in the tropopause region over the Himalayas and the Rocky Mountains. To avoid those errors a procedure was developed in which the pressure forces, calculated from analyzed geopotentials in the p-system, are interpolated to sigma levels. For consistency a reversed procedure must be applied at the end of a forecast when results are to be displayed on pressure surfaces. When the pressure force is

interpolated, the geopotential fields on the sigma surfaces are obtained by solving a set of vertically coupled elliptic partial differential equations. The problems involved in solving this set by relaxation (SOR) are analyzed. Author (ESA)

N76-31571 Grenoble Univ. (France).
APPROXIMATE METHODS FOR COMPUTING THE EIGEN-ELEMENTS OF INTEGRAL AND DIFFERENTIAL LINEAR OPERATORS
Francoise Chatelin *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 5, May 1976 May 1976 p 15-19 refs (For availability see N76-31569 22-39)

N76-32119 European Space Agency, Paris (France).
NONLINEAR PSEUDO-SPLINES
Pierre Diringer *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 62-83 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 155-163 Presented at the Symp. on Technical and Scientific Numerical Calculation Methods, Paris, 18-20 Nov. 1974 (For availability see N76-32116 22-99)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-31966 Princeton Univ., N.J.
ROBUST NONLINEAR DATA SMOOTHERS: THEORY, DEFINITIONS, AND APPLICATIONS Ph.D. Thesis
Paul Flor Velleman 1975 195 p
Avail: Univ. Microfilms Order No. 76-20786

The problems associated with nonlinear smoothing are discussed and measures of smoother performance proposed. A wide variety of nonlinear smoothers is defined and many of them tested. Some high quality smoothers suitable for pencil and paper computation are presented and a family of reroughing w-smoothers is shown to give excellent performance for a wide variety of noise distributions. Finally, some applications are discussed and others proposed. Dissert. Abstr.

N76-31967*# Scientific Translation Service, Santa Barbara, Calif.
OPTIMAL EXPERIMENTAL PLANNING IN A REGRESSION MODEL
H. Bandemer and W. Jung Washington NASA Aug. 1976 21 p refs Transl. into ENGLISH from Biometrische Z. (East Germany), v. 16, no. 5, 1974 p 323-336
(Contract NASw-2791)
(NASA-TT-F-17181) Avail: NTIS HC $3.50 CSCL 12A

Some basic notions and problems in the theory of optimal experimental design for the regression model are discussed. Author

N76-31968# Naval Civil Engineering Lab., Port Hueneme, Calif.
LABORATORY MANUAL FOR DESIGN AND ANALYSIS OF EXPERIMENTS
M. L. Eaton Feb. 1976 238 p refs
(AD-A021278; CEL-TN-810) Avail: NTIS CSCL 12/1

A manager who has just received his new task is immediately in some difficulty. Engineers and scientists by nature desire considerable accuracy in their findings. In conflict with this desire are two very severe boundary conditions; namely, a fixed cost limitation for the task and a completion dated deadline. This difficulty can be relieved, considerably, by careful planning before making any expeditures of time or money for experimentation. This planning includes formulating the problems and possibly designing some experiments. This manual consists of two parts. In Part I the author has compressed the main guidelines for design of an experiment into fifty pages. Part II consists of a series of short appendices, each written for its own specific purpose. It is here that the reader can expect to find definitions, basic probability and statistical concepts and operations, methods of data analysis, and a few designs not mentioned in Part I. GRA

N76-31969# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL PERT: AN IMPROVED SUBNETWORK ANALYSIS PROCEDURE THEMIS Optimization Research Program
R. L. Sielken, Jr., H. O. Hartley, and R. K. Spoeri Nov. 1975 124 p refs
(Contract N00014-68-A-0140; NR Proj. 047-700)
(AD-A020470; THEMIS-TR-51) Avail: NTIS CSCL 12/1

Statistical PERT is a new procedure for obtaining information about the distribution of a project's completion time when the project is comprised of a large number of activities and the time required to complete an individual activity once it can be begun is a random variable. The project is represented as an acyclic network whose arcs correspond to the project activities. This network is simplified by replacing various activity configurations by single equivalent activities and then decomposed into several subnetworks. The distribution and moments of each subnetwork's completion time are bounded and approximated on the basis of two points from each activity's completion time distribution by using some mathematical programming techniques and a new result in the theory of networks. The project's completion time distribution is then approximated by combining the approximate subnetwork distributions. This report describes several refinements in the subnetwork analysis procedure. GRA

N76-31970# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL PERT: DECOMPOSING A PROJECT NETWORK THEMIS Optimization Research Program
R. L. Sielken, Jr. and N. E. Fisher Nov. 1975 50 p refs
(Contract N00014-68-A-0140; NR Proj. 047-700)
(AD-A020471; THEMIS-TR-50) Avail: NTIS CSCL 12/1

Statistical PERT is a new procedure for obtaining information about the distribution of a project's completion time when the project is comprised of a large number of activities and the time required to complete an individual activity once it can be begun is a random variable. The project is represented as an acyclic network whose arcs correspond to the project activities. This network is simplified by replacing various activity configurations by single equivalent activities and then decomposed into several subnetworks. This report documents two computer programs. The first program BREAKUP decomposes a project network into several subnetworks which are connected in either series or parallel in the project network. The second program LOOP checks a given project network for loops (cycles) since any loop would contradict the assumed acyclic structure of the project network. GRA

N76-31971# North Carolina Univ., Chapel Hill. Dept. of Statistics.
INEQUALITIES FOR Ek(X,Y) WHEN THE MARGINALS ARE FIXED Interim Report
Stamatis Cambanis, Gordon Simons, and William Stout (Univ. Ill., Urbana-Champaign) Jan. 1976 22 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 9769)
(AD-A023133; Mimeo-Ser-1053; AFOSR-76-0326TR) Avail: NTIS CSCL 12/1

When k(x,y) is a quasi-monotone function and the random variables x and y have fixed distributions, it is shown under some further mild conditions that Ek(x,y) is a monotone functional of the joint distribution function of x and y. Its infimum and supremum are both attained and correspond to explicitly described joint distribution functions. Author (GRA)

N76-31972# Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
OPERATIONAL COMPARISON OF STOCHASTIC STREAMFLOW GENERATION PROCEDURES Technical Report, 1 Jan. - 30 Jun. 1975
Stephen J. Burges and Dennis P. Lettenmaier Nov. 1975 125 p refs
(Contracts DI-14-31-0001-5084; DI-14-31-0001-3034)
(PB-249857/4; W76-04727; OWRT-A-073-WASH(1); TR-45)
Avail: NTIS HC $5.50 CSCL 08H

Operational comparisons are presented using the sequent peak algorithm to estimate probability storage distributions resulting from use of short and long memory synthetic annual

streamflow generators at a single site. The short memory model used was the Lag one Markov process, while a Fast Fractional Gaussian Noise (FFGN) generator was used to generate self-similar (long memory) sequences. In addition, a simpler model of long term effects, the ARMA (1,1) process, was compared to the FFGN generator. In all cases, 1000 sequences each of length 40 were used to generate the empirical probability storage distributions, which were approximated using an Extreme Value Type I distribution. Skewed marginal distributions were modelled using a three parameter log normal distribution. The model parameters (taken as population values) which were investigated were coefficient of variation, lag one correlation coefficient, skew coefficient and (for self-similar models) Hurst coefficient. For each trace, the storage required to satisfy constant annual demand to mean annual flow ratios of 0.5, 0.7, and 0.9 were derived. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-31973# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
A SIMPLE NETWORK INTERACTING PROGRAMS' EXECUTIVE (SNIPE)
N. W. Dawes May 1976 10 p refs
(NPL-NAC-66) Avail: NTIS HC $3.50

A small operating system, SNIPE, was developed to enable minicomputers on the NPL network to be used from terminals anywhere on this network. The system allows users to load and run programs over the network and provides network input and output facilities (eg: for file transfers) with terminals and other computers. The overall features and construction of this system are described. Instructions for its use are detailed in the SNIPE user's manual. Author (ESA)

N76-31974# George Washington Univ., Washington, D.C. Program in Logistics.
QUEUEING MODELS FOR SPARES PROVISIONING
Donald Gross, Henry D. Kahn, and Joseph D. Marsh 31 Dec. 1975 32 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A021261; SERIAL-T-322) Avail: NTIS CSCL 12/2

A population of items which break down at random times and require repair is studied (the classic 'machine repair problem'). It is desired to determine the number of repairmen and spares required over a multi-year planning horizon to provide for a service criterion of 90% availability. When an item fails, it is transported to the repair depot, repaired, and then transported to the spares pool (which is constrained to be empty not more than 10% of the time). The first model considered treats transportation and repair as one service operation. The second model is a series queue which allows for the separate treatment of transportation and repair. Breakdowns are assumed Poisson and repair times, exponential. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-31975 Brandeis Univ., Waltham, Mass.
PROJECTIVE METHODS IN THE THEORY OF DEFORMATIONS OF COMPACT SPACES AND VARIETIES Ph.D. Thesis
Edoardo Sernesi 1976 65 p
Avail: Univ. Microfilms Order No. 76-16938

Earlier work by Markoe-Rossi, Riemenschneider et al., have studied the possibility of resolving an isolated singularity of a local complex space, deforming the resolution and blowing down. Some of their results were generalized to the global projective case. In particular a criterion is given for constructing a family of projective varieties by 'simultaneously blowing down' a given family of projective manifolds. Some questions were investigated on the notion of L-dimension of a compact complex space, introduced by Iitaka, and on the Kodaira-dimension of a compact complex manifold. Some results on the behavior of such dimensions under deformation were proven. In particular the following was proven: Theorem: Let X be a compact manifold of general type such that some positive power of the canonical bundle is generated by its global sections. Then every deformation of X over an irreducible base space is again a manifold of general type. Dissert. Abstr.

N76-31976 Michigan State Univ., East Lansing.
SYMMETRIC GROUP ANALYSIS OF MULTISPINOR LAGRANGIANS Ph.D. Thesis
Mary Lucille Larsen 1976 86 p
Avail: Univ. Microfilms Order No. 76-18644

The second- and third-rank multispinor Lagrangians were reviewed and the respective wave functions were identified as objects which transform under the appropriate symmetric group. Each multispinor is transformed into tensor components, and field equations are found in that formulation. The fourth-rank multispinor wave functions are presented, and the spin-0 Lagrangian for this rank is constructed on the basis of symmetric group considerations. The transformation from multispinor to tensor form is carried out. The field equations on the tensor components which result upon variation assure the Bargmann-Wigner equations on the spin-0 field and the vanishing of the auxiliary fields. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-31977 State Univ. of New York, Stony Brook.
STABILITY OF NONLINEAR OSCILLATORY SYSTEMS Ph.D. Thesis
Juan Lin 1976 203 p
Avail: Univ. Microfilms Order No. 76-19691

The averaging technique of Krylov-Bogoliubov-Mikopolskii (K-B-M) is used to solve several nonlinear models with oscillatory behavior. A class of one predator-one prey systems which incorporate a functional response of the predator is studied in detail. The K-B-M method allows the calculation, under certain conditions, of the radius of the limit cycle, and the renormalized frequency of the system's response. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-31978*# Boeing Commercial Airplane Co., Seattle, Wash.
NOISE AND STATIC PERFORMANCE CHARACTERISTICS OF A STOL AIRCRAFT JET FLAP Final Report
D. L. Harkonen, J. F. McBride, and J. V. OKeefe Dec. 1974 61 p refs
(Contract NAS2-7641)
(NASA-CR-137581; D6-42312) Avail: NTIS HC $4.50 CSCL 20A

Static noise and performance tests were conducted on a 1/4-scale jet flap model with a multilobe nozzle of array area ratio of 2.7. The model nozzle and flap tested were a two-dimensional section of a distributed blowing system similar to previously investigated augmentor wing systems without the upper shroud and intake door. Noise data were measured with the nozzle alone and also during attached flow conditions with the flap at two turning angles representing takeoff and approach conditions. The noise data are scaled to a 200,000-lb TOGW four-engine airplane and are presented in terms of perceived noise level and one-third octave band sound pressure level. Comparisons are made with the noise levels produced by an

augmentor wing airplane fitted with a three-element acoustically lined augmentor flap. The static performance is presented in terms of thrust recovery and effective turning angle. Author

N76-31979*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF THE ACOUSTIC IMPEDANCE OF DUCT LINERS
William E. Zorumski and Brian J. Tester Sep. 1976 65 p refs
(NASA-TM-X-73951) Avail: NTIS HC $4.50 CSCL 20A

Recent research which contributes to the prediction of the acoustic impedance of duct liners is reviewed. This review includes the linear and nonlinear properties of sheet and bulk type materials and methods for the measurement of these properties. It also includes the effect of grazing flow on the acoustic properties of materials. Methods for predicting the properties of single or multilayered, point reacting or extended reaction, and flat or curved liners are discussed. Based on this review, methods for predicting the properties of the duct liners which are typically used in aircraft engines are recommended. Some areas of needed research are discussed briefly. Author

N76-31980# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
EXPERIMENTS ON THE FEASIBILITY OF AERO-ACOUSTIC MEASUREMENTS IN THE 3-m-LOW-SPEED WIND-TUNNEL OF THE DFVLR-AVA
Friedrich-Reinhard Grosche, Hartmut Holst, and Rudolf Wulf 26 Nov. 1975 42 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-52) Avail: NTIS HC $4.00; DFVLR, Cologne DM 19,90

Noise measurements were conducted in a 3-m low-speed wind tunnel to investigate the feasibility of using this tunnel for aero-acoustic tests. The experiments include measurements of the tunnel noise and measurements of the noise of a high subsonic jet emanating from a nozzle of 5 cm diameter located in the test section of the wind tunnel. The noise level of the jet was 10 to 20 dB higher at frequencies above 2 kHz than the noise level of the tunnel, although a large airplane model producing additional flow noise was installed in the test section.
Author (ESA)

N76-31981# European Space Agency, Paris (France).
FREE JET TEST SET-UP FOR AEROACOUSTIC EXPERIMENTS
Werner Dobrzynski Apr. 1976 31 p refs Transl. into ENGLISH of 'Freistrahlpruefstand zur Durchfuehrung von akustischen Modellversuchen', DFVLR, Trauen, West Ger. Report DLR-Mitt-75-22, 3 Nov. 1975 Original German report available from DFVLR, Cologne DM 14.60
(ESA-TT-288; DLR-Mitt-75-22) Avail: NTIS HC $4.00

The setup described consists of an acoustic plenum chamber, followed by a convergent square nozzle of 0.09 sq m cross-sectional area with a subsequent flat plate for the attachment of test objects. Maximum free jet speed is 60 m/s. Measurements of velocity profiles and turbulence intensities served to check the aerodynamic quality of the free jet and to identify optimum locations for test objects. The noise floor of the operational test stand was determined for various free jet speeds; typical signal-to-noise ratios were obtained using several representative test objects. Possibilities for improving the aerodynamic quality of the flow and for lowering the noise floor are discussed.
Author (ESA)

N76-31982# European Space Agency, Paris (France).
ON THE AMPLIFICATION OF BROAD BAND JET NOISE BY A PURE TONE EXCITATION
Dietrich Bechert and Eberhard Pfizenmaier Apr. 1976 21 p refs Transl. into ENGLISH of 'Ueber die Verstaerkung von Breitband-Strahllaerm durch eine Einzeltonanregung', DFVLR, Berlin Report DLR-FB-75-72, 6 Nov. 1975 Original German report available from DFVLR, Cologne DM 10.40
(ESA-TT-292; DLR-FB-75-72) Avail: NTIS HC $3.50

It has been found experimentally that broad band jet noise can be amplified by a pure tone excitation as much as 6 to 7 dB. The jet noise amplification effect takes place at sound pressure levels present in real aircraft engines. The experimental investigation was restricted to a cold jet at high subsonic Mach numbers excited by a plane sound wave coming from inside the nozzle. Based on a simplified mathematical model, an attenuator was developed which can reduce jet noise amplification significantly. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-31983+ Pennsylvania State Univ., Hershey.
CROSS SECTIONS AND RATES FOR THE EXCITATION OF COMPLEX IONS BY ELECTRON IMPACT Ph.D. Thesis
Allen Danforth Parks 1975 222 p
Avail: Univ. Microfilms Order No. 76-18389

A method for obtaining electron impact cross sections for excitation of highly charged ions suggested by Burgess, Hummer, and Tully was implemented. The single configuration scaled collision strength expressions for all transitions in one and two valence electron ions in the limit of infinite atomic number obtained previously are reviewed. This method is then extended to give expressions for the single configuration scaled collision strengths for the principal transitions in three valence electron ions in the same limit. The expressions for the one, two and three valence electron ion collision strengths reduce to a very simple form involving hydrogenic ion collision strengths when configuration mixing is neglected. These expressions have been applied to the available hydrogenic ion data to obtain numerical results for transitions involving principal quantum number less or equal to 3. This approach has also been extended to include configuration mixing. The accuracy increases with the atomic number along an isoelectronic series until the effect of relativistic corrections becomes large. Dissert. Abstr.

N76-31984 Stanford Univ., Calif.
INELASTIC COLLISIONS INDUCED BY INTENSE OPTICAL RADIATION Ph.D. Thesis
Derek Balfour Lidow 1976 100 p
Avail: Univ. Microfilms Order No. 76-18783

A new type of optical interaction with matter is described that invoives the efficient exchange of stored energy from one atomic specie to another atomic specie in the presence of a specified intense optical field. The optical field is chosen such that the energy of the incident photons is equal to the energy difference between the specific interacting atomic levels; in essence in a nonresonant atomic collision energy may be conserved by the additional optical photon. An impact parameter approach to the collisional coupling of the two atoms gives the cross section for the inelastic collision proportional to the incident power density of the applied optical field. Dissert. Abstr.

N76-31985 Baylor Univ., Waco, Tex.
THE APPLICATION OF THE RANDOM PHASE APPROXIMATION TO SOME ATOMS WITH ns-2 GROUND STATE CONFIGURATIONS Ph.D. Thesis
Lawrence A. Wright Jun. 1975 150 p
Avail: Univ. Microfilms Order No. 76-17141

Atomic bound state properties such as excitation energies and oscillator strengths were calculated by the Random Phase Approximation (RPA), also known as the Time Dependent Hartree-Fock Approximation (TDHFA). The RPA is equivalent to describing excited states as the creation of particle-hole pairs and is shown to be superior to the TDHFA in three basic ways: (1)The RPA contains explicit correlations between the excited and ground states. These are not included in the TDHFA. One can apply this method to large atoms since only these correlations are explicitly included. (2) The RPA calculates excitation energies directly without recourse to highly correlated ground state wavefunctions. This is in contrast to the method of configuration mixing which is known to have slow convergence properties. (3)Oscillator strengths and photoionization cross sections can be calculated by finding the eigenvectors corresponding excitation

energy eigenvalues. The present work was limited to atoms with an ns2 ground state configuration. Dissert. Abstr.

N76-21986*# Kanner (Leo) Associates, Redwood City, Calif.
EVOLUTION OF THE ELECTRONIC PROPERTIES OF CARBON IRRADIATED BY NEUTRONS
J. Rappeneau, G. Micaud, A. Pacault, A. Marchand, and J. Amiell Washington NASA Aug. 1976 14 p refs Transl. into ENGLISH from Carbon (England), v. 8, 1970 p 55-61
(Contract NASw-2790)
(NASA-TT-F-17192) Avail: NTIS HC $3.50 CSCL 20L

Two nuclear graphites, a well oriented graphite PGCCL and a pyrocarbon deposited at 2,100 C, were irradiated with neutrons at 35 C. The electronic properties such as dia- and paramagnetic susceptibilities, Hall effect, magnetoresistance, and electrical resistivity were measured, at room temperature, as a function of the irradiation dose. The studies show that the damage is less pronounced when the carbon is better ordered. Author

N76-31987# Kanner (Leo) Associates, Redwood City, Calif.
INTERPRETATION OF ROTATION-VIBRATION SPECTRA OF MOLECULES WITH TETRAHEDRAL OR OCTAHEDRAL SYMMETRY
Jr. Moret-Bailly 1975 109 p refs Transl. into ENGLISH from Cahiers de Physique (Paris), no. 131-132, 1961 p 237-314 Prepared for Los Alamos Scientific Lab., N. Mex.
(Contract W-7405-eng-36)
(LA-tr-75-15) Avail: NTIS HC $5.50

Rotation-vibration spectra of spherical tops molecules, whose main types are methane and sulfur hexafluoride, is studied. It is shown that the general theory of rotation-vibration spectra must be modified for the study of the spherical tops. The theory of irreducible spherical tensors is generalized so it can be adapted to problems with no revolution symmetry. The general theory is particularized in the case of systems with cubic symmetry. The cubic tensors thus defined are used to write the development up to the third order of the rotation-vibration Hamiltonian of the spherical tops. The matrix elements of this Hamiltonian are calculated in a representation which yields a diagonal energy matrix with respect to the quantum index of orientation of the kinetic momentum in the molecule. Formulas are presented which make it possible to calculate the energies of the three-fold degenerate fundamental transitions by a perturbation method. This theory is applied to the V4 band of methane, and a satisfactory interpretation of the experimental results is obtained. NSA

N76-31988# Oak Ridge National Lab., Tenn.
INVESTIGATIONS OF RADIATIVE ELECTRON CAPTURE BY ION CHANNELING TECHNIQUES
B. R. Appleton, R. H. Ritchie, J. A. Biggerstaff, T. S. Noggle, S. Datz, C. D. Moak, and H. Verbeek Feb. 1976 22 p refs Presented at the 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco
(CONF-760209-8) Avail: NTIS HC $3.50

The unique constraints imposed on the interactions of energetic heavy ions as a result of the channeling effect are utilized to investigate the phenomena of radiative electron capture (REC) for 17 to 40 MeV oxygen ions. Measured cross sections and widths of the REC radiation are compared with calculations made specifically for the channeling situation. NSA

N76-31989# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF NEGATIVE ION DETACHMENT RATES Final Report
A. Mandl Jan. 1976 18 p refs Sponsored in part by SAMSO
(Contract F44620-75-C-0032; AF Proj. 6813; AF Proj. 9750)
(AD-A023280; AFOSR-76-0166TR) Avail: NTIS CSCL 07/5

A series of collisional electron detachment rates has been measured for Cl(-) and Br(-). The negative ions are produced by shock heating the cesium halide salts CsCl and CsBr, respectively. The measurements were made between 3500K and 5500K. The reactions and rates were measured. Measurements have been made of the photo-detachment cross sections for Cl(-) and Br(-) from their threshold values down to 2000A. The results are found to be in good agreement with the calculated values of Robinson and Geltman. The cross sections for the photo-dissociation of CsCl and CsBr have also been measured. The measurements were made at 1900K between 4000A and 2000A. GRA

N76-31990# Whittaker Corp., Waltham, Mass. Space Sciences Div.
ION BEAM DEPOSITED CARBON COATINGS FOR BIO-COMPATIBLE MATERIALS Annual Report, 1 Dec. 1974 - 30 Nov. 1975
S. Aisenberg and R. W. Chabot Feb. 1976 62 p refs
(Grant HB-3-2919)
(PB-253089/7; SSD-P-860) Avail: NTIS HC $4.50 CSCL 06L

Ion Beam Deposited (BD) carbon coatings for blood compatability studies were deposited in 500A-1000A thickness polymeric substrates. Since coatings are thin, the surface roughness seen by the blood is essentially that of the substrate. The use of methane gas in the coating process results in the considerable presence of hydrocarbons at the surface. Samples using no hydrocarbon gas have been prepared and sent out for comparative study. ESCA and Auger analysis also indicate the presence of silicon at the IBD carbon surface. Latest renal embolus test results have been excellent and vena cava testing over the past year has generally indicated a moderate degree of thromboresistance. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-31991 Cornell Univ., Ithaca, N.Y.
DIODE COMPRESSION OF A HIGH CURRENT RELATIVISTIC ELECTRON BEAM WITH AN EXTERNALLY DRIVEN AXIAL CURRENT Ph.D. Thesis
Michael Edwin Read 1976 158 p
Avail: Univ. Microfilms Order No. 76-18194

A primarily experimental examination of the behavior of a high current relativistic electron beam in a quasi-planar diode was presented. The regimes of uncompressed and compressed flow are explored, with particular consideration to the transition regime. Emphasis is placed upon the dependence of the character of the beam flow on the azimuthal magnetic field strength and the magnitude and extent of plasma in the diode. Control of the magnetic field is effected and injection of plasma accomplished in order to delineate the effects of these variables. A description of the experiment is given. A field emission diode is pulsed by a 1/2 MeV, 70 kA, 100 nanosecond electron accelerator. The diode consists of solid planar anode with an annular cathode, machined such that a conductor for an externally driven current can be placed on axis and isolated from the cathode. Beam impedances are found to increase with increasing externally supplied axial current, scaling qualitatively as predicted by the parapotential flow model. Dissert. Abstr.

N76-31992 Columbia Univ., New York.
PART A: ON A SIMPLE POLYAKOV MODEL. PART B: CONFINEMENT AND SHIELDING IN A MASSIVE-MASSLESS SCHWINGER MODEL Ph.D. Thesis
Achin Sen 1976 82 p
Avail: Univ. Microfilms Order No. 76-17839

A simplified bootstrap type model of Polyakov for the annihilation of electrons and positrons to hadrons was first studied. Simple momentum space and coordinate space pictures of the annihilation process are described which turn out to be useful in deriving the gross features like the power law growth of the average multiplicity. The consistency of the Polyakov model with the renormalization group equations is investigated. It is found that the anomalous dimension of the underlying field theory plays a very crucial role in making the basic assumptions of the model justified. It was also shown that in a Schwinger-type two-dimensional Q.E.D. model with both massless and massive fermions the massive fermions are produced as physical states at least for small values of a particular coupling constant. This

is exhibited by studying the analyticity structure of the current correlation function. Dissert. Abstr.

N76-31993# Battelle Pacific Northwest Labs., Richland, Wash.
INCORPORATION OF HIGH LEVEL RADIOACTIVE WASTE IN GLASS: A REVIEW
J. E. Mendel and J. L. McElroy 1975 25 p Presented at the 77th Ann. Meeting of the Am. Ceramic Soc., Washington, D. C., 3 May 1975 Sponsored by ERDA
(BNWL-SA-5370; Conf-750542-3) Avail: NTIS HC $4.25

The incorporation into glass of high level radioactive wastes resulting from the reprocessing of fuel from light water power reactors is reviewed. NSA

N76-31994# Battelle Pacific Northwest Labs., Richland, Wash.
SINTERING OF RADIOACTIVE WASTES INTO A GLASS MATRIX
W. A. Ross Apr. 1975 19 p refs Presented at 77th Ann. Meeting of the Am. Ceramic Soc., Washington, D. C., 3 May 1975 Sponsored by ERDA
(BNWL-SA-5362; Conf-750542-4) Avail: ERDA Depository Libraries HC $4.00

From the work that has been done on sintering of radioactive wastes into a glass matrix the following conclusions were made: (1) waste calcines can be incorporated into a glass matrix at temperatures below 675 C; (2) the pellets are impervious and about 90 percent dense; (3) leach resistance of sintered pellets of spray calcines and frits are comparable to glass; (4) microstructures indicate that glass sintering is both reacting and encapsulating the waste in the glass matrix; and (5) storage temperatures should not exceed 700 C to avoid bloating and swelling. NSA

N76-31995# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
ANNUAL PROGRESS REPORT FY 1975
K. F. Hansen and A. F. Henry Apr. 1975 92 p refs
(Contract AT(11-1)-2262)
(COO-2262-5) Avail: NTIS HC $7.75

Numerical methods suitable for the computer solution of problems in reactor dynamics and safety are developed. Specific areas of research include methods of integration of the time dependent diffusion equations by finite difference and finite element methods; representation of reactor properties by various homogenization procedures; application of synthesis methods; and development of response matrix techniques. Author (NSA)

N76-31996# Institut fuer Material- und Festkoerperforschung, Leopoldshafen (West Germany). Inst. fuer Material und Festkoerperforschung.
INFLUENCE OF DEACTIVATION PROCESSES ON SINTERING OF UO2-OXIDE FUEL
H. Pollanz and A. Gutu Nov. 1975 40 p refs In GERMAN
(KFK-2226) Avail: ERDA Depository Libraries HC $4.00

Methods were studied of sintering and final density control by deactivation processes using UO2-oxide fuel. It was shown that sinterability decreases as a function of heating rate, the influence on final densities of sintered compacts being very small. Activated sintering by addition of ppM-amounts of water vapor to the sintering gas influences/pellet densities in a specific way. NSA

N76-31997# Air Force Weapons Lab., Kirtland AFB, N.Mex.
MEASUREMENTS OF VACUUM ULTRAVIOLET RADIATION, NEUTRONS, AND IONS FROM THE INTERACTION OF AN INTENSE RELATIVISTIC ELECTRON BEAM AND A DEUTERATED POLYETHYLENE TARGET Final Report
John R. Kerns and David J. Johnson Mar. 1976 32 p refs
(AF Proj. 8809)
(AD-A022889; AFWL-TR-75-250) Avail: NTIS CSCL 18/1

The interaction of a tightly pinched relativistic electron beam from a Bennett cathode and a deuterated polyethelene target has been studied using diagnostics sensitive to vacum ultraviolet and neutron radiation. Target plasmas produced by three electron accelerators were analyzed. X-ray pinhole camera photographs indicated plasma sources equal to or less than 75 micrometers in diameter. Maximum plasma temperatures of 50 ev were detected and conversion efficiencies of approximately 0.1% from electron beam energy to X-ray radiation were measured. Neutron production was attributed to the beam-target mechanism resulting from the acceleration of up to 10 to the 14th power ions/str-MeV across the anodecathode gap. Author (GRA)

74 OPTICS

Includes light phenomena.

N76-31998* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPTICAL NOISE SUPPRESSION DEVICE AND METHOD Patent
Joseph L. Horner, inventor (to NASA) (Dept. of Transportation, Cambridge, Mass.) Issued 31 Aug. 1976 7 p Filed 30 Jun. 1975 Supersedes N75-28871 (13 - 19, p 2451) Sponsored by NASA
(NASA-Case-MSC-12640-1; US-Patent-3,977,771; US-Patent-Appl-SN-591568; US-Patent-Class-350-162SF) Avail: US Patent Office CSCL 20F

A device and method is disclosed for suppression of optical noise in an optical spatial filtering system using highly coherent light. In the disclosed embodiment, input photographic film to be processed in the system, and output photographic film to be exposed, are each mounted on lateral translation devices. During application of the coherent light for exposure of the output film, the two translation devices are moved in synchronism by a motor-driven gear and linkage assembly. The ratio of the resulting output film translation to the input film translation is equal to the magnification of the optical data processing system. The noise pattern associated with the lenses and other elements in the optical processing system remains stationary while the image-producing light moves laterally through the pattern with the output film, thus averaging out the noise effect at the output film. Official Gazette of the U.S. Patent Office

N76-31999*# Kanner (Leo) Associates, Redwood City, Calif.
ANISOTROPY BETWEEN CROSSED NICOL PRISMS UNDER DIRECT ILLUMINATION
Max Berek Washington NASA Aug. 1976 25 p refs Transl. into ENGLISH from Z. Krist. (Frankfurt), v. 89, 1934 p 125-143
(Contract NASw-2790)
(NASA-TT-F-17171) Avail: NTIS HC $3.50 CSCL 20F

A description is given of effects observed when polished sections of anisotropic media are placed between crossed nicols and illuminated, both when the polarization of the incident light in the entire field is homogeneous and strictly linear, and when, as is usually the case, it is inhomogeneous and has both azimuthal and elliptical errors. These effects are highly important in diagnostic analysis of such observations. It was found that the polarization of the incident light must satisfy certain very strict conditions in order that the anisotrophy effects can be observed with purity sufficient for diagnostics. The technical tools and adjusting instructions to generate such a polarization field are given. Author

N76-32000*# Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF OPTICAL ANISOTROPY CONSTANTS OF ABSORBING CRYSTAL CROSS SECTIONS BY OBSERVATIONS OF POLARITY IN PERPENDICULARLY REFLECTED LIGHT
Max Berek Washington NASA Aug. 1976 25 p refs Transl. into ENGLISH from Z. Krist. (Frankfurt), v. 93, 1936 p 116-135
(Contract NASw-2790)
(NASA-TT-F-17173) Avail: NTIS HC $3.50 CSCL 20F

The determination of anisotropic parameters from the anistropic effects of absorbing minerals between crossed nicols in reflected light by means of an elliptical analyzer was demonstrated. Parameters are characteristic for optical symmetry, complex optic character, the level of complex double refraction, and for the behavior of both uniradial reflection capacities of the crystal cross section. Author

N76-32001*# Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF SURFACE LAYERS ON THE DETERMINATION OF OPTICAL CHARACTERISTICS OF CRYSTALS IN PERPENDICULAR INCIDENCE OF DIRECT LIGHT
Max Berek Washington NASA Aug. 1976 11 p refs Transl. into ENGLISH from Z. Krist. (Frankfurt), v. 96, 1937 p 357-364
(Contract NASw-2791)
(NASA-TT-F-17174) Avail: NTIS HC $3.50 CSCL 20B

By using very short wave radiation, experience was gained about the nature of surface layers produced by the cutting and polishing process. The influence of these layers was investigated for perpendicularly reflected, polarized light, and it is shown how one may determine the thickness of the surface layer, approximately, by measuring the anisotropic parameters between crossed nicols. This results in agreement with the findings of radiographic methods of investigation. Indications of the significance of the influence of these layers to practical mineral microscopy are given. Author

N76-32002# Denver Univ., Colo.
PHYSICAL OPTICS FAR FIELD INVERSE SCATTERING IN THE TIME DOMAIN
N. Bleistein 1976 31 p refs
(Contract AF(11-1)-2482)
(COC-2482-4) Avail: NTIS HC $4.00

The physical Optics Far Field Inverse Scattering (POFFIS) identity relates the phase and range normalized far field back scattering amplitude to the spatial Fourier transform of the characteristic function of the scattering obstacle. The characteristic function is equal to unity in the region occupied by the obstacle and zero elsewhere. The original identity was derived by Bojarski for impulsive point sources. The result is extended to sources of arbitrary time dependence. Obtained was an alternative form of Bojarski's POFFIS identity. Also derived was A POFFIS identity in the time domain. Numerically synthesized checks on the method are provided. Author (NSA)

N76-32003# Pennsylvania State Univ., University Park.
COATING SCIENCE AND TECHNOLOGY
Bruce E. Knox and K. Vedam 15 Jul. 1975 20 p refs
(Contract F19628-75-C-0110; ARPA Order 2415)
(AD-A021268; AFCRL-TR-76-0001; STAR-1) Avail: NTIS CSCL 20/6

An ion plating unit was constructed and some preliminary studies made using germanium and cadmium telluride as the principal materials deposited. Both glass and potassium chloride were used as substrates. Electron microscopy was used to characterize some organic films produced by plasma polymerization. Electron micrographs, selected area diffraction, and high resolution diffraction techniques were used. The crystalline films gave reflections which indicated a cubic system which could be indexed as diamond. Work continues on the automation and computer control of the ellipsometer and the ion scattering spectrometer. GRA

N76-32004# Illinois Univ., Urbana. Radio Research Lab.
OPTICAL MATCHED FILTER RECEIVER PERFORMANCE IN ATMOSPHERIC TURBULENCE Final Report
Chester S. Gardner Mar. 1976 58 p refs
(Grant NSF GK-42079)
(PB-252380/1; UILU-ENG-76-2542; RRL-Pub-473) Avail: NTIS HC $4.50 CSCL 20F

The problem of reducing scintillation noise in optical and millimeter wave receivers is considered. It is shown that under conditions of weak scattering, scintillation noise can be completely removed from the received signal if the signal is appropriately processed. One practical realization of the optimum signal processing is a matched spatial filter receiver where the filter is matched to the spatial distribution of the unscattered signal. The performance is examined to detail with particular attention given to the effects of receiver misadjustments and beam wander. The matched filter receiver is also compared with the conventional aperture averaging receiver. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-32005 Maryland Univ., College Park.
A HYBRID-KINETIC MODEL FOR COLLISIONLESS HIGH-BETA PLASMAS Ph.D. Thesis
Daniel Anthony Dippolito 1975 173 p
Avail: Univ. Microfilms Order No. 76-17787

A hybrid-kinetic model (Vlasov ions and drift-kinetic electrons) is developed to describe the equilibrium and stability properties of collisionless high-beta plasmas in arbitrary magnetic field configurations. The ions are described by the exact (unexpanded) Vlasov equation. The electrons are assumed to be strongly magnetized, and the electron Vlasov equation is expanded in a series. The resulting drift-kinetic description of the electrons includes kinetic behavior along the direction of the magnetic field, but it retains only the gyrophase-averaged particle drifts perpendicular to the magnetic field direction. To complete the model, the electromagnetic fields are determined self-consistently from a combination of Maxwell's equations with moment equations. Complex equilibrium configurations (toroidal geometry, arbitrary cross-section, etc.) can be described in the hybrid-kinetic model with considerable flexibility, a feature which is not true in a fully kinetic description. A systematic discussion of hybrid-kinetic equilibrium solutions as a function of symmetry and time scale of interest is presented. Dissert. Abstr.

N76-32006# Ecole Polytechnique Federale de Lausanne (Switzerland).
EIGEN OSCILLATIONS OF THE ION CYCLOTRON BEAM-WHISTLER TURBULENCE EXCITED IN COLLISIONLESS PARALLEL SHOCK WAVES
Liu Chen (Princeton Univ.) and K. I. Golden (Northeastern Univ.) Jul. 1976 9 p refs
(LRP-109/76) Avail: NTIS HC $3.50

Eigen structures and growth rates are obtained for the ion cyclotron beam whistler plasma instability near the leading edge of a shock wave propagating along the magnetic field. Author

N76-32007# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ASYMPTOTIC EXPANSION OF NONLINEAR UNSTABLE COLLISIONAL DRIFT WAVE
T. Hatori and Y. Terashima Jun. 1976 18 p refs
(IPPJ-251) Avail: NTIS HC $3.50

A nonlinear theory of the collisional drift instability is developed in a slab model based on the two fluid equations where the ion inertia, finite gyroradius and viscosity are included. A systematic expansion is introduced by taking epsilon = (kappa) (l) as a smallness parameter where kappa is the degree of density gradient and l is the linear scale of the slab along the density gradient. A set of the model equations is derived, which can describe the nonlinear evolution of the drift wave. Author

N76-32008# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TURBULENT DIFFUSION COEFFICIENT OF PLASMA WHICH DEPENDS INVERSELY ON DENSITY
Sanae Inoue, Kimitaka Itoh, and Shoichi Yoshikawa Jun. 1976 14 p refs
(IPPJ-248) Avail: NTIS HC $3.50

A possible interpretation of the plasma confinement scaling in the Alcator experiment was presented. In the regime where the collision frequency (CF) is less than or equal to the maximum drift frequency (MDF), the diffusion coefficient (D) is modified from the pseudo-classical diffusion (PCD) to the value D = (PCD) (k), where k = (MDF)(MDF)/((CF)(CF)) due to the electron inertia effect. This electron inertia diffusion shows that the confinement time (tau) is proportional to the product of the plasma density and plasma current squared, divided by the electron temperature to the power 7/2; under the experimental conditions considered, tau is 25 milliseconds. Author

N76-32009# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR HELICAL EQUILIBRIUM OF A CURRENT-CARRYING PLASMA

Kimitaka Itoh, Sanae Inoue, and Shoichi Yoshikawa May 1976 11 p refs
(IPPJ-247) Avail: NTIS HC $3.50

A finite amplitude solution to the problem of helical equilibria for current-carrying plasmas bounded by a perfectly conducting cylinder is obtained. The nonlinear saturation levels of the fixed boundary MHD modes are also obtained near the marginal stable points. It is shown that by shaping the current density profile the saturation levels can be suppressed. Author

N76-32010# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MHD INSTABILITY OF PLASMA COLUMN INDUCED BY INJECTION OF STRONG CURRENT ION BEAMS
K. Ikuta and K. Yamanaka May 1976 21 p refs
(IPPJ-246) Avail: NTIS HC $3.50

It is theoretically predicted that a magnetohydrodynamic instability is induced by the strong ion beam injection perpendicularly into the plasma column. Its growth rate is of order kC sub A, where C sub A is the Alfven velocity and K is the wave number along the magnetic field. Author

N76-32011# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON DENSITY MEASUREMENT OF A TOKAMAK PLASMA BY AN HCN LASER INTERFEROMETER
Akimitsu Nishizawa, Masaru Masuzaki, and Akihiro Mohri Apr. 1976 29 p refs
(IPPJ-244) Avail: NTIS HC $4.00

An HCN-laser interferometer has been constructed for the electron density measurement of plasmas. The output power of the HCN laser has been adjusted for long-term operation. The interferometer is of the Michelson-type with a concave mirror as the reflecting mirror so as to reduce the refractive effect due to plasmas. The mean electron density of SPAC-II Tokamak plasma (of the order of 3 to 7.5 times 10 to the 13 power/cu cm) was measured by this interferometer. The signal-to-noise ratio was 20, which was mainly determined by the fluctuation of the laser output power. Changes of the phase shift corresponding voltage spikes in the one-turn-loop voltage signal were also observed. Author

N76-32012# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FORMATION OF REVERSE PINCH CONFIGURATION IN STATIC TOROIDAL FIELD
K. Ikuta May 1976 9 p refs
(IPPJ-245) Avail: NTIS HC $3.50

The possibility of producing a reverse pinch mode in a static toroidal field in fusion reactor, by using two kinds of energetic beams was studied. It is shown that a strong current ion beam of an energy of 20 MeV is required for the fusion reactor to achieve the reverse pinch mode. Author

N76-32013# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands).
EDDY CURRENTS IN THE ALCATOR TOKAMAK
D. C. Schram and J. Rem Mar. 1975 52 p refs Sponsored by Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Euratom
(NP-20787; Rijnhuizen Report-75-88) Avail: ERDA Depository Libraries HC $4.50

A one-dimensional model of an aircore transformer is developed through which it is possible to analyze the effect of eddy currents in the primary windings--and of similar currents in the field coils for the toroidal magnetic field--on the time dependence of the current in a Tokamak experiment. The model is applied to the Alcator Tokamak, and its accuracy is tested by comparing analytical results for the harmonic behavior of the transformer, with experimental data. The time dependent behavior of the plasma current--for a constant plasma resistance--shows that eddy currents in the primary windings will lead to a reduction of 8% of the current maximum. The eddy currents in the Bitter coils are found to affect predominantly the initial current rise, they lead to a steepening of the current rise. Finally, the influence of the time dependence of the plasma resistance is investigated. Author (NSA)

N76-32014# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands).
BEHAVIOR OF IMPURITIES IN A STEADY-STATE DT GAS-BLANKET REACTOR
J. A. Markvoort Nov. 1975 37 p Sponsored by Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Euratom
(NP-20785; Rijnhuizen Report-75-90) Avail: ERDA Depository Libraries HC $4.00

A four-fluid model of a cylindrical steady-state DT gas-blanket reactor is analyzed. The four fluids are electrons, deuterium-tritium, helium, and a high-z impurity. In this model the fuel supply, a 50/50 deuterium-tritium mixture, and the ash removal take place by diffusion, while the fusion energy is carried off by heat conduction in addition to neutron radiation and Bremsstrahlung. The radial temperature gradient and an externally applied magnetic field perpendicular to it, give rise to a thermal force (the Nernst effect) which drives a poloidal current. It is this poloidal current together with the applied axial magnetic field that cause the kinetic pressure to be much larger in the center than at the boundary. The behavior of the plasma is described by the multifluid MHD-equations which are numerically solved with the aid of a Runge Kutta method. Author (NSA)

N76-32015# Oak Ridge National Lab., Tenn.
NEUTRONIC SCOPING STUDIES FOR THE TOKAMAK EXPERIMENTAL POWER REACTOR
R. T. Santoro, E. S. Bettis, D. G. McAlees, H. L. Watts, and M. L. Williams Feb. 1976 29 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5035) Avail: NTIS HC $5.00

One-dimensional neutron and photon radiation transport methods were used to investigate candidate blanket configurations and compositions for use in the Tokamak Experimental Power Reactor. Seven blanket designs are compared in terms of energy recovery, radiation attenuation, potential radiation damage, and, where applicable, tritium breeding. Author (NSA)

N76-32016# Sandia Labs., Albuquerque, N.Mex.
ENGINEERING CONCEPTS IN FUSION
G. Yonas 1976 18 p refs Presented at the 16th Ann. ASME Symp. on Energy Alternatives, Albuquerque, N. Mex. Sponsored by ERDA
(SAND-76-5203; CONF-760215-2) Avail: NTIS HC $3.50

The major approaches to controlled fusion are described. Some of the engineering concepts involved with each approach are outlined. NSA

N76-32017# California Univ., Livermore. Lawrence Livermore Lab.
RECENT DEVELOPMENTS IN LASER PLASMA THEORY AND SIMULATIONS
W. L. Kruer 1975 19 p refs
(Contract W-7405-eng-48)
(UCRL-77731) Avail: NTIS HC $3.50

The principal recent developments are that (1) nonlinear steepening of the density profile strongly modifies absorption processes near the critical density, (2) a sizeable stimulated reflection of light can occur, and (3) energy transport by hot electrons is impeded either by the need to draw a return current, by ion fluctuations generated by this return current, or by self-generated magnetic fields. A brief overview of these results is presented. NSA

N76-32018# California Univ., Livermore. Lawrence Livermore Lab.
MEASUREMENT OF THE DISTRIBUTION OF VERY ENERGETIC IONS IN THE PLASMA FOCUS DEVICE
R. L. Gullickson 8 May 1975 24 p refs Presented at the IEEE Intern. Conf. on Plasma Sci., Ann Arbor, Mich., 14 May 1975 Sponsored by ERDA
(UCRL-76831; Conf-750531-3) Avail: NTIS HC $4.00

The C-12(d,n)N-13 reaction was used to monitor the distribution of deuterons in the plasma focus device having energies exceeding 330 keV, the reaction threshold. Carbon discs, placed at various angles and distances from the anode of a plasma focus device having a stored energy of 75 kilojoules at 18 kV, were analyzed following the shot to determine the N-13 activity. Low pressure operation (1 torr deuterium) produced a substantially greater number of energetic deuterons than did high pressure (5 torr D2) operation with the low pressure distribution

more shapely peaked in the forward direction. This is consistent with previous data which showed that low pressure operation maximized electron acceleration as determined by hard X-ray measurements. Author (NSA)

N76-32019# Princeton Univ., N.J. Plasma Physics Lab.
ANOMALOUS TRANSPORT AND STABILIZATION OF COLLISIONLESS DRIFT-WAVE INSTABILITIES
W. W. Lee and H. Okuda Dec. 1975 16 p refs
(Contract E(11-1)-3073)
(MATT-1188) Avail: NTIS HC $3.50

Extensive numerical simulations were carried out to study the enhanced transport processes associated with the collisionless drift wave instabilities. The results indicate that the shear is effective in reducing the anomalous particle diffusion as predicted by theory; however, it is less so for the accompanied electron heat transfer. The quasilinear decay of the density profile is found to be the dominant mechanism for the nonlinear saturation. Author (NSA)

N76-32020# Princeton Univ., N.J. Plasma Physics Lab.
EFFECTS OF LOW Z IMPURITIES DURING THE STARTUP PHASE OF A LARGE TOKAMAK
R. J. Hawryluk and J. A. Schmidt Jan. 1976 20 p refs
(Contract E(11-1)-3073)
(MATT-1201) Avail: NTIS HC $4.00

The requirements placed on a Tokamak ohmic heating system (i.e. loop voltage) to initiate the plasma become more severe as the size increases because of the current density decrease. During the startup phase even small concentrations of low Z impurities can affect the plasma energy balance very substantially and have very important effects on the evolution of the discharge. The startup phase has been studied using a simple zero dimensional computer code. Because the dominant energy loss mechanisms during startup, radiation, and ionization are a volume effect, the zero dimensional code was adequate to treat this phase. The results of this study which have been applied to TFTR indicate that the plasma evolution is a sensitive function of the applied loop voltage, impurity concentration, initial filling pressure and the manner in which gas is fed into the discharge. Author (NSA)

N76-32021# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA FOCUS PROJECT
H. L. Sahlin Dec. 1975 22 p refs
(Contract W-7405-eng-48)
(UCID-16989) Avail: NTIS HC $3.50

The primary objective of this project was to provide a relatively simple pulsed power source for high density pulsed fusion studies with a variety of DT and other fusion microexplosion targets. plasma gun that operates on DT at 1 MJ may produce greater than or equal to 10 to the fifteenth DT neutrons per pulse corresponding to 2,800 J of nuclear energy release. Because of its X-ray and neutron production potential, the operation of the plasma gun as an X-ray source is also under study, and an initial design study for a repetitively pulsed 1 MJ plasma gun as a pulsed neutron materials testing source was completed. The plasma gun seems particularly appropriate for application as a materials testing source for pulsed fusion reactors, for example, based on laser driven fusion microexplosions. The construction status of the device is described. NSA

N76-32022# California Univ., Berkeley. Lawrence Berkeley Lab.
THEORETICAL STUDIES OF SOME NONLINEAR LASER-PLASMA INTERACTIONS
B. I. Cohen 15 Aug. 1975 214 p refs
(Contract W-7405-eng-48)
(LBL-3291) Avail: NTIS HC $7.75

The nonlinear coupling of intense, monochromatic, electromagnetic radiation with plasma is considered in a number of special cases. A general formulation of the stimulated scattering of transverse waves by longitudinal modes in a warm, unmagnetized, uniform plasma is constructed. A general dispersion relation is derived that describes Raman and Brillouin scattering, modulational instability, and induced Thomson scattering. Raman scattering (the scattering of a photon into another photon and an electron plasma wave) is investigated as a possible plasma heating scheme. Analytic theory complemented by computer simulation is presented describing the nonlinear mode coupling of laser light with small and large amplitude, resonantly excited electron plasma waves. The simulated scattering of a coherent electromagnetic wave by low frequency density perturbations in homogeneous plasma is discussed. A composite picture of the linear dispersion relations for filamentation and Brillouin scattering is constructed. Author (NSA)

N76-32023# Princeton Univ., N.J. Plasma Physics Lab.
EXPERIMENTAL STUDIES OF LOWER HYBRID WAVE PROPAGATION
P. Bellan and M. Porkolab Jan. 1976 42 p
(Contract E(11-1)-3073)
(MATT-1196) Avail: NTIS HC $4.00

Measurements of the dispersion and damping of externally excited lower hybrid waves are presented. A multiple ring slow wave antenna, having 2 pi/k/sub z/ equals 23 cm, was used to excite these waves in linear devices (B equals 0.5 to 2.8 kG uniform to + or - 1 percent for 1.6 m, n approximately 10 to the 10th power, T/sub e/ approximately 3 to 5 eV, T/sub i/less than or equal to 0.1 eV He gas, plasma diameter approximately 10 cm). The waves were localized in a spatial wave packet that propagated into the plasma along a conical trajectory which made a small angle with respect to the confining magnetic field. Measurements of the dependence of wavelength on frequency were in good agreement with the cold plasma dispersion relation. Measured values of the wave damping were in good agreement with Landau damping by the combination of the main body of the electron distribution and an approximately 30 percent high energy (T/sub e/approximately 15 to 30 eV) electron tail. Author (NSA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-32024 Princeton Univ., N.J.
ELECTRON BEAM-INDUCED IMAGING AND ANALYSIS OF INTERNAL STRUCTURE IN THE METAL-INSULATOR-SEMICONDUCTOR STRUCTURE Ph.D. Thesis
Daniel Charles Guterman 1976 226 p
Avail: Univ. Microfilms Order No. 76-20799

A technique for imaging internal structure in metal-insulator-semiconductor devices was developed. The focussed electron beam of a scanning electron microscope is used to induce currents within MIS samples. Images sensitive to variations in these currents are thus formed. Most of the samples studied were conventional MOS structures, however those with implanted oxides and capacitors incorporating Al2O3 dielectric films were also examined. Dissert. Abstr.

N76-32025 Commissariat a l'Energie Atomique, Saclay (France). Lab. d'Electronique et de Technologie de l'Informatique.
STUDY OF ZINC TELLURIDE: METALLURGY AND ION IMPLANTATION DEVICES Final Report [ETUDE DU TELLURE DE ZINC: METALLURGIE ET ETUDE DU DISPOSITIF REALISE PAR IMPLANTATION IONIQUE]
Verdone and Mareschal Mar. 1975 82 p refs In FRENCH
(Contract DGRST-77-7-1724)
Avail: Issuing Activity

A study on Zn telluride is presented with a view to obtaining green electroluminescent devices. The technology used is described noting the absence of oxygen and the possibility of increasing the quantum yield from 1% to 4% by phosphor addition. The ion implantation was treated with regard to characterization of the intrinsic zone formed ahead of the maximum ion penetration depth. The various parameters to be considered are discussed. It is shown that the greatest part of the implantation defects should be eliminated by ionic abrasion or chemical action. A process to make electrolumiscent diodes was established leading to the fabrication of seven element matrices for digital display. ESA

N76-32026*# Kanner (Leo) Associates, Redwood City, Calif.
THE PROBLEM OF QUANTITATIVE MICROSCOPY OF ORE MINERALS AND ITS SOLUTION
Max Berek Washington NASA Aug. 1976 27 p refs Transl into ENGLISH from Z. Krist. (Frankfurt), v. 77, 1931 p 1-22
(Contract NASw-2790)
(NASA-TT-F-17170) Avail: NTIS HC $4.00 CSCL 20B

Of all the parameters which can be measured when light is reflected from absorbing media, the reflectivity is the best and most widely applicable in the diagnosis of ore minerals. Under certain circumstances, the bireflection of anisotropic ore minerals can also be determined. A good method for determining these parameters with a microscope has been worked out and a slit microphotometer has been developed as a suitable apparatus. Reflection measurements made with a microscope are more reliable than previous physical measurements using macroscopic analyses. Author

N76-32027*# Kanner (Leo) Associates, Redwood City, Calif.
KINETIC STUDY OF THE GRAPHITIZATION OF P 33 CARBON BLACK: EPR AND DIAMAGNETISM
A. Marchand and J. Amiell Washington NASA Aug. 1976 32 p refs Transl. into ENGLISH from Carbon (England), vol. 8, 1970 p 707-726
(Contract NASw-2790)
(NASA-TT-F-17193) Avail: NTIS HC $4.00 CSCL 20L

Samples of P 33 carbon black, heat treated in the range 1600-2900 C, were studied by EPR electron paramagnetic resonance. The line intensity, localized and carrier spins contributions, and g-factor are examined as a function of residence time at HTT (15 min to 8 h). Analysis of the kinetics of the graphitization process yields an apparent activation energy of 140 kcal. It is pointed out that the concentration of localized spins is considerably smaller than the concentration of carriers. These results, as well as the correlation between the g-factor and diamagnetic anisotropies, are discussed. Author

N76-32028*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRON PARAMAGNETIC RESONANCE STUDY OF A PURE VITRINITE CARBONIZED AT VARIOUS TEMPERATURES
A. M. Alquie, A. P. Legrand, J. Uebersfeld, R. Chauvin, and P. Chiche Washington NASA Aug. 1976 14 p refs Transl. into ENGLISH from Carbon (Oxford), vol. 10, 1972 p 401-07
(Contract NASw-2791)
(NASA-TT-F-17194) Avail: NTIS HC $3.50 CSCL 20L

The variation of the electron spin resonance signal of a pure vitrinite (Barnsley seam, Dinnington Colliery, South Yorkshire) carbonized at various temperatures and showing only a simple line in the natural state was investigated. A hyperfine structure is observed above a treatment temperature of 600 C, near the center of the wide line. Author

N76-32029*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN IMPROVED METHOD AND APPARATUS FOR USE IN EXAMINING THE LATTICE OF A SEMICONDUCTOR WAFER BY X-RAY DIFFRACTION Patent Application
Donald L. Parker (Tex. A & M Univ., College Station) and Wilbur A. Porter, inventors (to NASA) (Tex. A & M Univ., College Station) Filed 20 Sep. 1976 14 p Sponsored by NASA
(NASA-Case-MFS-23315-1; US-Patent-Appl-SN-724874) Avail: NTIS HC $3.50 CSCL 20L

New techniques were proposed for evaluating semiconductor devices including, specifically, a method and apparatus which facilitates rapid, nondestructive identification of lattice defects, including strains generated in crystalline semiconductor wafers during the fabrication of semiconductor devices. The method includes the step of recording the image of the wafer supported in a bent configuration conforming to a compound curve; this is produced through the use of a vacuum chuck provided for an X-ray camera while the entire surface is illuminated simultaneously by a beam of incident X-rays projected from a distant point-source. These X-rays satisfy conditions of the Bragg Law for all points on the surface of the wafer. It is then possible to rapidly analyze crystal defects (including strains) using X-ray topography. NASA

N76-32030# Connecticut Univ., Storrs.
VACUUM uv SPECTRA OF MOLECULAR CRYSTALS Final Report, 1 Feb. 1971 - 30 Jun. 1975
C. W. Peterson 30 Jun. 1975 8 p refs
(Contract AT(11-1)-3142)
(COO-3142-5) Avail: NTIS HC $3.50

The broad goal of this work is the characterization of the optical and electronic properties of molecular crystals and biomaterials in the vacuum uv region. Work can be summarized in two general areas: (1) setting up and implementing a general facility for normal incidence reflection spectroscopy in the vuv region, with accompanying computer analyses for optical constants and derived functions. Detailed results were obtained on two molecular crystals in the form of thin films of tetraphenylporphyrin and its magnesium compound MgTPP, (2) initiating a program to determine the VUV photoemission properties of biomaterials and thereby completely delineate their electronic structure. The requisite ultrahigh vacuum system was finalized and key components designed and fabricated; preliminary data will be taken by the end of the year on the prototype molecular crystal TPP. Author (ERA)

N76-32031# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering and Materials Science Center.
VOIDS, DISLOCATION LOOPS AND GRAIN BOUNDARIES AS SINKS FOR POINT DEFECTS
R. W. Balluffi Oct. 1975 24 p refs Presented at the Intern. Conf. on Fundamental Aspects of Radiation Damage in Metals, Gatlinburg, Tenn., 6-10 Oct. 1975
(Contract E(11-1)-2679)
(COO-2679-3) Avail: NTIS HC $4.00

Idealized atomistic models for the sink action are discussed. The overall problem of the kinetics of defect annealing to sinks is also considered. Additional complications are also discussed, including the effects of sink stresses on the defect diffusion to sinks and the enrichment, or depletion, of solute atoms at sinks by the defect currents. Experimental observations are included, and an attempt is made to summarize briefly the state of the field. Author (ERA)

N76-32032# Brookhaven National Lab., Upton, N.Y.
FIRST-ORDER TRANSITIONS, SYMMETRY, AND THE EPSILON-EXPANSION
D. Mukamel, S. Krinsky, and P. Bak 1975 37 p refs Presented at 21st Ann. Conf. on Magnetism and Magnetic Materials, Philadelphia, 9 Dec. 1975
(BNL-20619; Conf-751209-16) Avail: NTIS HC $5.00

The group theoretical method of Landau and Lifshitz was used to derive effective Hamiltonians for certain paramagnetic to antiferromagnetic transitions having order parameters with n greater than, or equal to 4 components. A renormalization group analysis in 4 epsilon dimensions was performed. The first order nature of the order disorder transitions in Cr(n equals 12), Eu(n equals 12), UO2(n equals 6), and MnO(n equals 8) was explained by noting that the corresponding Hamiltonians possess no stable fixed points in 4 epsilon dimensions. It is predicted that all fcc type I(anti m perpendicular anti k), type II and type III(anti m perpendicular /100/, anti k equals /1/2 01/, antiferromagnetic transitions are first order. A 2m-component Hamiltonian is also considered which describes the paramagnetic to antiferromagnetic transitions in TbAu2, DyC2, Tb, Ho, Dy, and the structural transition in NbO2. Author (NSA)

N76-32033# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
THE EFFECT OF GASES ON THE CONDUCTIVE PROPERTIES OF ORGANIC SEMICONDUCTORS. PART 6: RESULTS FOR FILMS OF PHTALOCYANINE AND BETA NAPHTOL IN A FLOW SYSTEM
P. C. M. vanWoerkom Apr. 1975 17 p refs
(Contract A74/K/020)
(CL-1975-16; TDCK-66815) Avail: NTIS HC $3.50

The effect of gaseous contaminants in air on the conductivity of phthalocyanine and beta naphtol was investigated in a flow system. Phthalocyanine films were subjected to soman, sarin, and tabun in a vacuum system. Results obtained with a flow system show that phthalocyanine is probably unsuitable for the detection of warfare agents because of its high sensitivity to NO2. Contrarily beta naphtol may be a useful organic semiconduc-

tor due to its high sensitivity to some phosphorus containing compounds. Author (ESA)

N76-32034# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LUMINESCENCE FROM COPPER-DOPED AND UNDOPED GALLIUM PHOSPHIDE M.S. Thesis
Larry A. Hill Dec. 1975 144 p refs
(AD-A021271; GEO/PH/75-11) Avail: NTIS CSCL 20/12

A luminescence study of high-purity GaP and GaP:Cu was made to determine the identity of inadvertent impurities present in the crystals. The GaP crystals were excited with an argon ion laser operating at 4579A and 100mw of power. The luminescence was detected photoelectrically for sample temperatures ranging from 4.2K to 100K. The identification of the impurities was made by comparing the luminescence spectra from the samples with the luminescence spectra for GaP found in the literature. The inadvertent impurities present were identified as nitrogen, sulfur, carbon, silicon and possibly oxygen for the copper-doped samples. In addition, a possible source of the impurities is suggested. GRA

N76-32035# Little (Arthur D.), Inc., Cambridge, Mass.
FEASIBILITY INVESTIGATIONS OF GROWING AND CHARACTERIZING GALLIUM ARSENIDE CRYSTALS IN RIBBON FORM Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
J. B. Berkowitz Apr. 1975 23 p
(Grant NSF GI-43093)
(PB-252358/7; NSF/RANN/SE/GI-43093/PR-74-4; NSF/RA/N-75-195; QPR-1) Avail: NTIS HC $3.50 CSCL 20B

The feasibility of continuous production of gallium arsenide ribbon single crystals, by passage of a molten zone through boron-oxide encapsulated GaAs feedstock, is being investigated. Polycrystalline GaAs ribbons were grown in graphite boats by passage of a wide zone through B2O3-encapsulated feed-stock, confined by a quartz cover plate. Failure to remove the encapsulant above its glass transition temperature, however, resulted in cracking of the ribbons on cooling to room temperature. In order to study the crucial zone melting step in isolation from the encapsulation steps of the continuous process, a constrained-zone melting apparatus was constructed in which the boron oxide serves only as a sealant to suppress arsenic vaporization. GRA

N76-32036# Army Electronics Command, Fort Monmouth, N.J.
CHEMISTRY OF MESOMORPHIC COMPOUNDS Final Report, May 1963 - Jan. 1971
Wolfgang Elser, Juergen L. W. Pohlmann, and Phillip R. Boyd Nov. 1975 53 p refs
(DA Proj. 1T1-61102-A-31B)
(AD-A023526; ECOM-7047) Avail: NTIS CSCL 07/3

This final report summarizes synthetical efforts in the chemistry of cholesteric liquid crystals and the temperature sensitivity of their visible selective reflection spectra. Eleven homologous series of alkanoates, omega-phenylalkanoates, alkyl carbonates, and S-alkyl thiocarbonates of cholesterol, cholest-5-en-3 beta-thiol, and 5 alpha-cholestan-3 beta-o1 were prepared and their mesomorphic properties investigated. In addition, numerous other derivatives of these and other 3 beta-sterols were synthesized in order to study the influence of various parameters, such as modified 17 beta-side chain, double bonds, and polar substituents on the mesomorphic properties. The research culminated with the discovery that S-cholesteryl 14-phenyltetradecanethioate reflects the spectral range of 420-600 nm within 0.07C and thereby allows the detection of temperature variations of 2 x 0.00002C. GRA

N76-32037# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
A COMPUTER PROGRAM FOR THE SIMULATION OF X-RAY DIFFRACTION INTENSITY BANDS Final Report
J. Unnam, D. R. Tenney, J. A. Carpenter, and C. R. Houska Feb. 1976 67 p refs
(Grant NSF GH-30180)
(PB-252580/6; VPI-E-76-9) Avail: NTIS HC $4.50 CSCL 20B

A computer program has been developed to simulate the X-ray intensity diffracted from planar one dimensional diffusion couples. It is written for cubic single crystals having any set of (hkl) planes parallel to the surface. A convolution subroutine is employed to allow for instrumental or other forms of X-ray line broadening. Cauchy or Gaussian broadening functions can be selected to broaden the K sub alpha 1 line. An auxiliary program has also been developed to calculate the X-ray reflectivity and linear absorption coefficients as function of composition for any binary alloy system that has either a book centered cubic (BCC) or a face centered cubic (FCC) crystal structure. GRA

N76-32038# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
EXPLORATORY STUDY ON MICROANALYSIS WITH 100-700 keV ACCELERATORS Semiannual Progress Report, 1 Jan. - 31 Jul. 1975
Aug. 1975 36 p refs
(Grant NSF AER-73-03265)
(PB-252840/4; NSF/RANN/SE/AER73-03265/PR-74; NSF/RA/N-75-235; SAPR-2) Avail: NTIS CSCL 20L

One processing step has been added in the standard sample fabrication procedure by vacuum depositing a thin layer of Sb before the deposition of the amorphous Si layer. The resulting solid phase epitaxial growth Si layer was analyzed by Auger electron spectrometry and Hall effect, by the dc characteristics of the layer against the substrate, and by SEM operated in the electron beam induced current mode. The evidence that the layer is n-type and well doped is convincing. SPEG has two regimes: a fast transient growth and a slower steady-state growth. The experiment succeeded in forming SPEG Si layers with Ni and Pd. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-32039# California Univ., San Diego. Center for Human Information Processing.
STUDIES OF LEARNING AND SELF-CONTAINED EDUCATIONAL SYSTEMS, 1973-1976 Final Report, 1 Feb. 1973 - 31 Jan. 1976
Donald A. Norman Mar. 1976 54 p refs
(Contract N00014-75-C-0757; ARPA Order 2284; NR Proj. 154-360)
(AD-A023033; Rept-7601) Avail: NTIS CSCL 05/9

This research has centered upon the study of the representation of knowledge in memory and of the learning and teaching processes for complex topic matters. An active structural network, a type of semantic network, has been used to represent both knowledge and procedures within the same data base. An event schema representation has been developed to study the acquisition and organization of complex events. In particular, the schema representation has been used to study students learning American Civil War history or how to program in the computer language FLOW. The studies of the learning and teaching processes have been primarily concerned with developing models of the student and with building automated tutorial instructional systems. The automated systems have given us a controlled environment in which to observe learning and teaching, and the two contrasting topic areas of history and programming have been used to help

insure the generality of our models. By the technique of incremental simulation in which the computer performs whatever aspects of the tutorial project are fully understood and human tutors enact the roles of other system components, we have been extending our understanding of the interactions among the components of the overall tutorial system. The goal is to develop a theoretical model of the learning of complex material. Author (GRA)

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-32040*# Kanner (Leo) Associates, Redwood City, Calif.
TECHNICAL CAPACITY OF UNDERGROUND COAL MINING AND ITS MEASUREMENT
R. Tillessen Washington NASA Aug. 1976 39 p refs Transl. into ENGLISH from Bergabu-Archiv (Essen), vol. 24, no. 3/4, 1963 p 23-34
(Contract NASw-2790)
(NASA-TT-F-17179) Avail: NTIS HC $4.00 CSCL 05A

Determination of the technical capacity of existent mines is described. The effects on technical capacity of the various production factors are considered on the basis of general management principles. These factors are labor, the coal deposit, and operating resources, including facilities and equipment. The most important factor is found to be operating resources. Formulas are given for measuring component capacities, and a flow chart is used to determine overall capacity from them. Author

N76-32041*# Kanner (Leo) Associates, Redwood City, Calif
VALUATING ENTIRE MINING OPERATIONS
S. VonWahl Washington NASA Aug. 1976 56 p refs Transl. into ENGLISH from Bergbau Arch. (West Germany), v. 24, no. 3/4, 1963 p 65-81
(Contract NASw-2790)
(NASA-TT-F-17180) Avail: NTIS HC $4.50 CSCL 05A

Algorithms are derived for calculating the values of businesses with limited lives (specifically, mines) and businesses with interminate lives on the basis of investment and conventional methods. A hypothetical mining operation is used as a model to which the methods can be applied; the results are compared in the form of total value curves and curves for future profit value and replacement value. Author

N76-32042*# Scientific Translation Service, Santa Barbara, Calif.
THE NATURE OF COST FUNCTION STRUCTURE IN MINING INDUSTRY AND ITS IMPORTANCE FOR RAISING PRODUCTION
D. Graner Washington NASA Aug. 1976 41 p refs Transl. into ENGLISH from Bergbau Arch. (West Germany), v. 24, no. 3/4, 1963 p 35-39
(Contract NASw-2791)
(NASA-TT-F-17182) Avail: NTIS HC $4.00 CSCL 08I

The cost dependent structure of mining industries is considered. The problem was to split the plant operations to the point where elementary combinations only of production factors were left; for these basic units the dependence between costs and production speed was described. The immediate task in this context is to arrive at statements on the total cost behavior of a mining industry; the plant political behavior schemes in the face of different sales situations then can be based on this knowledge. Author

N76-32043*# National Aeronautics and Space Administration, Washington, D.C.
MANAGING ORGANIZATION VITALITY M.S. Thesis - MIT, Cambridge
George P. Chandler, Jr. Jun. 1976 125 p refs Sponsored by NASA
(NASA-TM-X-74144) Avail: NTIS HC $5.50 CSCL 05A

The three major objectives are: (1) to measure the extent to which the organization renewal techniques have been adopted by organizations in both the private and public sectors; (2) to determine the overall results of these applications; and (3) to test a number of specific hypotheses regarding situational determinants of the success of this approach. It appears that top management involvement is the single most crucial determinant of the success of organization renewal. Organization renewal has considerable potential for increasing the commitment of individuals, and can have a significant positive influence on the results of the organization. Author

N76-32044*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PROJECT SCIENTIST'S ROLE IN SCIENTIFIC SPACECRAFT PROJECT MANAGEMENT M.S. Thesis - George Washington Univ.
Evan Logan Eller Jul. 1976 58 p refs
(NASA-TM-X-71179; X-682-76-157) Avail: NTIS HC $4.50 CSCL 05A

The project scientists is in a position which rates very high in terms of behavioral study recommendations. His influence over objectives is generally considered to be important. He is highly autonomous in a moderately coordinated environment. He has diverse managerial and technical functions and the performance of these functions require him to grow beyond his role as an experimenter. However, the position within the line organization for those interviewed is also very stimulating, rating almost as high by the same criteria. The role of project scientist may not be the dominant means of professional growth for the experienced scientific investigators. The influence which the project scientist exerts on the project and the stimulation of that position for him are determined largely by his position outside the defined project scientist role. The role of the project scientist is changing because the environment of those who become project scientists is changing. Author

N76-32045# Signals Research and Development Establishment, Christchurch (England).
INTERFACING A DATABASE MANAGEMENT SYSTEM TO CORAL
H. K. Nichols Jul. 1975 16 p ref
(SRDE-75015; BR49042) Avail: NTIS HC $3.50

A Database Management System (DBMS) is described in which the data is held in packed format, and consists of a number of record occurrences, each occurrence containing several data fields and indexed via a unique field value. The DBMS provides a number of functions which can operate on the data. These functions provide the means by which applications programs, which are written in CORAL, gain access to the data on the backing store. A considerable amount of protection is afforded by the DBMS, in that an applications program may only use those functions that it needs and may only reference those fields with which it is directly concerned. In addition, the access to any permitted field can be further constrained, to, for example 'Read only'. The data structures, defined within the CORAL applications program, through which the DBMS provides and accepts actual data values, are discussed, and the mapping between these and the backing store structures together with the implementation of the protection mechanism described. Possible advantages offered by enhancements to the CORAL 66 compiler are discussed. Author (ESA)

N76-32046# Institute for Defense Analyses, Arlington, Va.
OPPORTUNITIES FOR R AND D ACTION TO REDUCE ACQUISITION AND SUPPORT COSTS OF TACTICAL AIRCRAFT. VOLUME 1: SUMMARY Final Report, Nov. 1974 - Nov. 1975
Donald M. Dix and John Metzko Nov. 1975 66 p refs
(Contract DAHC15-73-C-0200)
(AD-A023038; IDA/HQ-75-17904-Vol-1; P-1141-Vol-1) Avail: NTIS CSCL 15/5

The objectives of this study are to relate capabilities of tactical aircraft to their acquisition and support costs, and to identify opportunities for R and D action which appear to offer substantial cost-reduction potential--with particular emphasis on support costs. The capabilities of tactical aircraft are defined in terms of force capability parameters: unit performance (range, specific vehicle thrust, payload, etc.), number of units, inventory value, availability, utilization, and age. A model is developed which relates these parameters to total force costs as a function of

performance-related design-technology characteristics (vehicle structural weight fraction, lift/drag ratio, engine specific fuel consumption, engine specific thrust). Opportunities for R and D action are defined in terms of three decision levels: alternative implementation policies, given a design; alternative designs, given a system concept; and alternative concepts. The potential downstream impact on force costs and capability of R and D actions at these levels is assessed using associated parameters of the model--alternative implementation policies, by means of potential changes in elements of cost; alternative designs, by means of potential changes in design-technology characteristics; alternative concepts, by means of potential changes in force capability parameters. The study is limited; data are largely confined to USAF fighter and attack aircraft; although a broad range of data is used, the data are unrefined; the rationale used as the basis for the model appears to explain the data, but alternative explanations are not explored. GRA

N76-32047# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences.
DECISION AIDING INFORMATION SYSTEM (DAISY) USER'S GUIDE Interim Report
E. G. Hurst, Jr., H. L. Morgan, and D. N. Ness 22 Jan. 1975 19 p refs
(Contract N00014-67-A-0216-0035; NR Proj. 049-331; NR Proj. 049-360)
(AD-A020646; Rept-75-01-02) Avail: NTIS CSCL 12/1

This paper describes the use of the system 'DAISY' which allows the user to access and manipulate decision structure files. Author (GRA)

N76-32048# Pennsylvania Univ., Philadelphia.
DAISY: A DECISION-AIDING INFORMATION SYSTEM Interim Report
E. G. Hurst, Jr., H. L. Morgan, and D. N. Ness 22 Jan. 1975 21 p refs
(Contract N00014-67-A-0216-0035; NR Proj. 049-331; NR Proj. 049-360)
(AD-A020647; Rept-75-01-05) Avail: NTIS CSCL 12/1

DAISY is an information and modelling system designed to aid persons making complex interconnected sequences of decisions. Decision processes such as tactical planning, military planning, or organizational planning and control are all examples of situations where DAISY can aid the decision maker. A few of its main features include the following: (a) dynamic check-list of decisions which need to be made at a given time; (b) access to a large data base of information; (c) ability to run management science models using current information to support decision making; and (d) the ability to specify conditions about which the decision maker wishes notification (e.g., ship within range of weaponry). All of these are embedded in a powerful interactive computer system. This system integrates the many functions often performed by several computer or manual systems and puts all of the power of these systems at the decision maker's fingertips. DAISY can be used in the following operating modes: (1) for training individuals in a particular complex decision process; (2) for aiding in the planning of a decision process which may have to take place (such as military scenarios); or (3) actually operating in the complex decision environment. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-32049# IBM Federal Systems Div., Gaithersburg, Md.
NAVY TECHNICAL MANUAL SYSTEM INFORMATION SYSTEM CONCEPT Final Report
Donald R. Hill 31 Dec. 1975 88 p
(Contract N00024-74-C-1259; WF55522420)
(AD-A020862; FSD-75-0175) Avail: NTIS CSCL 05/2

The Navy Technical Manual System (NTMS) is intended to support and improve the preparation, revision, storage, distribution, management and control of Navy technical manuals. This report presents a concept for an information system which supports the creation, preparation/revision and distribution of TM materials. GRA

N76-32050# IBM Federal Systems Div., Gaithersburg, Md.
NAVAL TECHNICAL MANUAL SYSTEM DESIGN STUDY. AN/BQQ-5 TECHNICAL DATA PRODUCT ANALYSIS Final Report
Thomas W. Carrington, Jr. 15 Jan. 1976 40 p
(Contract N00024-74-C-1259; WF55522420)
(AD-A020864) Avail: NTIS CSCL 05/2

The Navy Technical Manual System (NTMS) is intended to support and improve the preparation, revision, storage, distribution, management and control of Navy technical manuals. This report presents an analysis of existing systems documentation, AN/BQQ-5 Sonar, which is incorporating new maintenance philosophies and approaches. GRA

N76-32051# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
CSIRO INDEX. VOLUME 2, NUMBER 3, MARCH 1976
Mar. 1976 36 p
(PB-252354/6) Avail: NTIS HC $4.00 CSCL 05B

Titles of papers of the following subject areas are included: animal health, animal production, applied geomechanics, Australian numerical meteorology, building research, chemical physics, entomology, environmental mechanics, fisheries and oceanography, food research, horticultural research, irrigation, land resources management, land use research, mathematics and statistics, mineral chemistry, mineralogy, measurement, plant industry, process technology, protein chemistry, soils, solar energy studies, textile industry, textile physics, tribophysics, tropical agronomy. GRA

N76-32052# Young (Arthur) and Co., Washington, D. C.
TECHNICAL LITERATURE SEARCH SYSTEMS OF EPA. FINDINGS AND RECOMMENDATIONS
Jan. 1976 179 p
(Contract EPA-68-01-1780)
(PB-252641/6; EPA-220/1-76-001) Avail: NTIS HC $7.50 CSCL 05B

A management summary and detailed findings and recommendations as to continued support of the technical information dissemination missions as they relate to the systems included in the study are presented. The need for such systems is examined, and an action plan through which needed systems may be developed in an orderly fashion is described. GRA

N76-32053# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data Service.
UNION LIST OF SERIALS 1975
1975 223 p Sponsored by EPA and Patent and Trademark Office, Washington, D. C.
(PB-252472/6; NOAA-76022406) Avail: NTIS HC $7.75 CSCL 05B

This is the first issuance of a joint listing of serial holdings of the U.S. Environmental Protection Agency (EPA) (including the Illinois Institute for Environmental Quality), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Patent and Trademark Office. A total of 11,715 titles and 20,767 holdings are listed. The arrangement is alphabetical by serial title. GRA

N76-32054# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.
USER'S GUIDE TO ENDEX/OASIS: ENVIRONMENTAL DATA INDEX AND THE OCEANIC AND ATMOSPHERIC SCIENTIFIC INFORMATION SYSTEM
Jan. 1976 79 p
(PB-252471/8; KOAIS-1; NOAA-76030204) Avail: NTIS HC $5.00 CSCL 05B

The ENDEX (Environmental Data Index) and OASIS (Oceanic and Atmospheric Scientific Information System) provide to users a rapid, computerized referral to available environmental data files and published literature in the environmental sciences and marine and coastal resources, respectively. This publication

describes the services offered from both ENDEX and OASIS, and how to use them. It gives their data bases for referral to various types of desired information. Sample search results and descriptions of subject index to the ENDEX/OASIS data bases are included. GRA

N76-32055# Computer Sciences Corp., San Diego, Calif.
THE LIBRARY MANAGEMENT AND RETRIEVAL SYSTEM (LMARS) Research and Development Report, 1969 - 1976
Kathleen Youel and Theresa Clowes Feb. 1976 86 p refs
(Contract N000123-74-C-0312)
(AD-A022878; NUC-TP-499) Avail: NTIS CSCL 05/2

The Library Management and Retrieval System (LMARS) is an automated retrieval system developed jointly by personnel from the Naval Undersea Center's Technical Library and from Computer Sciences Corporation to provide bibliographic control of the Library's technical reports collection. LMARS generates a computer-produced catalog consisting of indexes by corporate author, personal author, title, report number, subject, and accession number. In addition to the printed indexes, the LMARS Program also generates the Library's list of new publications, recall notices for technical reports, custom bibliographies, and Current Alert notices of new acquisitions in specific areas. Several improvements to LMARS are currently in progress, including conversion of the indexes from paper copy to Computer Output Microfiche and the addition of an on-line retrieval capability. GRA

N76-32056# Defense Documentation Center, Alexandria, Va.
INFORMATION SCIENCES: INFORMATION CENTERS AND SPECIAL LIBRARIES Report Bibliography, Sep. 1959 - Sep. 1975
Feb. 1976 254 p refs
(AD-A022700; DDC/BIB-76-01) Avail: NTIS CSCL 05/2

This bibliography is a compilation of citations on Information Sciences: Information Centers and Special Libraries. This report includes references on technical information centers and special library operations. Four computer-generated indexes provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author. GRA

N76-32057# System Development Corp., McLean, Va.
THE SECURITY IMPLICATIONS OF PRIVACY
Arthur A. Bushkin Jun. 1975 19 p
(PB-253050/9; SP-3823) Avail: NTIS HC $3.50 CSCL 05I

The document presents a clarification of the issues surrounding the technical implications of present and pending privacy legislation. This discussion is used as a vehicle to present a candidate for a consensus position on an adequate level of security for preserving the individual's right to privacy. The conclusion reached is that a reasonable man tasked with providing security to protect an individual's right to privacy--given limited resources and the current state of the art in computer security--should in fact take steps to protect personal information from abuse by the authorized, but dishonest, employee or user of the computer system. GRA

N76-32058# Wisconsin Univ., Madison. Mathematics Research Center.
SOME EXPERIMENTS IN DIRECTORY ORGANIZATION A SIMULATION STUDY
Allen Reiter Dec. 1975 22 p refs
(Contract DAAG29-75-C-0024)
(AD-A022750; MRC-TSR-1608) Avail: NTIS CSCL 09/2

Using a simulation model, experiments were conducted on various directory organization schemes and their performance implications. In particular, the author tested the effects of a multiprogrammed environment on system throughput for retrieval operations. Analysis of the results shows that different factors are relevant to performance for the various systems, and that under some circumstances ISAM and hash-coding may lose the advantages they possess over B-trees in a stand-alone environment when multiprogramming is used. Some results of sharing data among simultaneous users are presented. GRA

N76-32059# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DIALOG SPECIFICATION PROCEDURES Final Report
Richard W. Pew and Ann M. Rollins Sep. 1975 90 p Revised
Sponsored by the Dept. of Agriculture
(PB-252976/6; BBN-3129-Rev; USDA-ASCS-123351034-Rev)
Avail: NTIS HC $5.00 CSCL 09B

The ASCS dialog specification procedures manual is intended to promote the development of easily interpreted, friendly dialogs by: (1) Encouraging uniformity of dialogs from one application to another; (2) exploiting the full capabilities of programmable terminals for creating effective genuinely interactive dialog; and (3) providing designer aids for dialog creation and documentation. These aids meet the requirements for communicating the dialogs that are created to programmers who must implement them and managers who must review and approve them from a users viewpoint. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-32060# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AERONAUTICAL ECONOMIC ESCALATION INDICES Final Report
Bobby Jackson and Craig Lentzsch Jul. 1975 26 p refs
(AD-A022795; ASD-Cost-Res-110B) Avail: NTIS CSCL 05/3

An attempt is made to forecast price level indexes of the aerospace industry taking under consideration the unprecedented inflation of 1973 - 1974 and its impact on the economic environment of the industry and the weapon acquisition process. Historical data for the years 1958-1975 were compiled to develop cost indexes for airframe, engine, and avionics. These data were projected relative to the Wharton Econometric Unit prediction of GNP deflator for years 1975-1983 to generate the forecasted indexes. Overhead was included to reflect this cost element's influence on total industry cost. Economic escalation due to inflation received the most priority and concern given the austere budgetary environment confronting the Department of Defense. Author

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-32061# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1976 AND FOR TRANSITION PERIOD 1 JULY - 30 SEPTEMBER 1976
Washington GPO 1975 137 p refs Rept. on H.R. 4700 for Comm. on Aeronautical and Space Sci., 94th Congr., 1st Sess., 5 May 1975
(S-Rept-94-103; GPO-47-396) Avail: US Capitol, Senate Document Room

An act to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management is presented and discussed. Author

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-32062 Arizona State Univ., Tempe.
APPLICATIONS OF LINEAR SYSTEM THEORY TO TRANSPORTATION SYSTEM DESIGN Ph.D. Thesis
Hoshang Firouztash 1976 161 p
Avail: Univ. Microfilms Order No. 76-19818

A ride quality criterion based on the maximum instantaneous values of acceleration and jerk is formulated, and a method is developed for relating the new measure of ride quality to the roughness of the guideway. It is shown that a limit on the maximum instantaneous guideway acceleration provides a sufficient condition for a comfortable ride. The method is demonstrated using vehicle models that include time-delayed inputs, multiple inputs, and multiple outputs. The effect of parameter variation for a single-suspension and a double-suspension system is studied. A procedure for the implementation of the method is outlined, and the usage of the proposed method is explained. The determination of an index (API) for obtaining less conservative results is suggested, and a flow diagram for obtaining acceptable values of this index is given. Dissert. Abstr.

N76-32063# World Meteorological Organization, Geneva (Switzerland).
URBAN CLIMATOLOGY AND ITS RELEVANCE TO URBAN DESIGN
T. J. Chandler 1976 79 p refs Sponsored by UN Environ. Program (UNEP)
(WMO-438; TN-149; ISBN-92-63-10438-7) Avail: NTIS HC $5.00; WMO, Geneva Sw. Fr. 15

As a guide to urban planners the various mass, moisture, heat and momentum exchanges within the urban boundary layer are discussed. The consequences of these as they collect the distribution patterns of each of the meteorological elements are described. The implications of urban climates to successful urban design are considered together with the logistics of the climate input into the planning process. ESA

N76-32064# Pennsylvania Transportation Inst., University Park.
AN EQUITY EVALUATION MODEL FOR URBAN MASS TRANSPORTATION: AN ASSESSMENT OF THE SPATIAL AND SOCIAL DISTRIBUTIONS OF BENEFITS AND COSTS Research Report
David C. Hodge Nov. 1974 222 p refs
(Grant DOT-PA-11-0010)
(PB-251205/1; PTI-7424) Avail: NTIS HC $7.75 CSCL 13B

The distribution of resources among members of society is considered. Public investment decision making in the provision of impure goods is discussed and a public investment model which describes investment issues as both a production and a distribution question is presented. Then, an alternative public investment model, the equity evaluation model which examines public investment as a distribution question, is examined. The mathematical foundation of distributional analysis, particularly the link between aggregate and distributional analysis, is discussed. GRA

N76-32065# Transportation Data Coordinating Committee, Washington, D.C.
GENERAL PROGRAMMING SPECIFICATION FOR A PROTOTYPE ELECTRONIC DATA INTERCHANGE SYSTEM Final Report, Jul. 1975 - Apr. 1976
J. Carley, R. Notto, E. Bass, A. Kreithen, and E. Gilbert 30 Apr. 1976 100 p
(Contract DOT-OS-50017)
(PB-252936/0) Avail: NTIS HC $5.00 CSCL 13B

A programming specification is presented for electronic data interchange of transportation information between shippers, carriers, forwarders, and banks which may be used for estimating, design, and development purposes. This specification was prepared in conjunction with working groups composed of participants from the transportation industry. GRA

N76-32066# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ANALYTICAL AND EXPERIMENTAL DETERMINATION OF NONLINEAR WHEEL/RAIL GEOMETRIC CONSTRAINTS Interim Report
N. K. Cooperrider, E. H. Law, R. Hull, P. S. Kadala, and J. M. Tuten 30 Dec. 1975 181 p refs Prepared jointly with Arizona State Univ., Tempe, Arizona and Assoc. of Am. Railroads, Chicago
(Contract DOT-OS-40018)
(PB-252290/2; FRA/ORD-76/244) Avail: NTIS HC $7.50 CSCL 13F

Wheel/rail geometric constraint relationships, such as the effective conicity and gravitational stiffness, strongly influence the lateral dynamics of railway vehicles. In general, these geometric constraints are nonlinear functions of the wheelset lateral displacement. The development and validation of an analytical procedure to determine these nonlinear functions for arbitrary wheel and rail profiles is discussed. Data for validation of this analysis were obtained experimentally. Experimental and analytical data for three validation cases are presented. Results of a limited parametric study are also reported. The computer program for the analytical procedure is described and documented. GRA

N76-32067# Boeing Vertol Co., Philadelphia, Pa.
SOAC: STATE-OF-THE-ART CAR ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION HIGH SPEED GROUND TEST CENTER. VOLUME 7: POST-REPAIR TESTS Final Report
Ray Oren Nov. 1975 206 p refs
(Contract DOT-TSC-580)
(PB-252337/1; UMTA-MA-06-0025-75-7;
DOT-TSC-UMTA-74-16-7) Avail: NTIS HC $7.75 CSCL 13F

The test results are presented for the State-of-the-Art Car Post-Repair Engineering Test Program. The SOAC has been developed under UMTA's Urban Rapid Rail Vehicle and Systems Program to enhance the effectiveness of rapid rail transportation to the urban traveller. The test data continuity between the original HSGTC Engineering Tests and the Post-Repair Test was established. A description of test procedures, equipment and facilities was provided. GRA

N76-32068# Booz-Allen Applied Research, Inc., Bethesda, Md.
BUS INTERIOR DESIGN FOR IMPROVED SAFETY Final Report, Oct. 1974 - Jun. 1975
30 Apr. 1976 58 p refs
(Contract DOT-UT-10008)
(PB-252253/0; BAARING-TR-76-001;
UMTA-IT-06-0029-76-1) Avail: NTIS HC $4.50 CSCL 13F

A project of testing and analysis directed at finding solutions to the problem of onboard accidents on transit buses which was conducted as part of the Transbus program is described. Accident statistics are discussed with respect to the onboard accident problem, the onboard accident scenario, interior hazards and potential design changes, and the deceleration problem. A comparison of the risk of onboard accidents to other everyday human risks is presented. An onboard accident test procedure was developed based upon knowledge gained from the accident data analysis. GRA

N76-32069# Naval Postgraduate School, Monterey, Calif.
TECHNOLOGY TRANSFER DIRECTORY OF PEOPLE, 1975. A LIST OF PERSONS INTERESTED IN THE PROCESS OF TECHNOLOGY TRANSFER
James A. Jolly and Joe D. Antinucci 1975 87 p
(PB-252465/0; NSF/RA-760007) Avail: NTIS HC $5.00 CSCL 05B

This is a directory of people. Its intent is to be of benefit to both the public and private sector in fostering communications between individuals interested in the process, concepts, framework and methodology of technology dissemination, transfer, and utilization. The directory is arranged by name, in alphabetical order, and contains the person's address, and areas of interest and expertise. GRA

N76-32070# Kappa Systems, Inc., Arlington, Va.
STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1975
Mar. 1976 581 p
(Contract DOT-NHTSA-6-5069)
(PB-252033/6; DOT-HS-801-849) Avail: NTIS HC $13.75 CSCL 13F

This is the seventh in a series of indexes to the Standards Enforcement Test Reports of the NHTSA. The first index covers

the year 1969 and is out of print, but is available for examination in the administration. Subsequent indexes are available from the National Technical Information Service. GRA

N76-32071# Iowa State Dept. of Transportation, Ames.
AN ECONOMIC ANALYSIS OF UPGRADING RAIL BRANCH LINES: A STUDY OF 71 LINES IN IOWA Final Report, Oct. 1974 - Mar. 1976
C. Phillip Baumel, John J. Miller, and Thomas P. Drinka Mar. 1976 577 p refs Prepared by Iowa State Univ. of Sci. and Technol.
(Contract DOT-FR-55045)
(PB-251978/3; FRA/OPPD-76-3) Avail: NTIS HC$13.75 CSCL 13B

Results are summarized of research conducted to determine the economic benefits and costs of upgrading 71 rail lines in Iowa and to estimate the impact of abandonment of these rail lines upon communities and individual businesses in the state. A benefit-cost ratio was estimated for each line. Benefits to shippers and receivers were defined as the change in the annual net revenue from shipping the projected 1980 volume of grain, plus the change in costs for handling and transporting the projected 1980 volume of all other products if the line were upgraded rather than abandoned. In addition, the impact of rail abandonment on highways, safety, and fuel consumption was estimated. GRA

N76-32072# Public Technology, Inc., Washington, D.C.
URBAN TECHNOLOGY SYSTEM. PHASE 3: OPERATIONS Annual Report, 1 Jul. 1974 - 30 Jun. 1975
J. L. Mercer 15 Mar. 1976 118 p refs
(Contract NSF C-834)
(PB-252296/9; NSF/RA-760044) Avail: NTIS HC$5.50 CSCL 13B

Major accomplishments resulting from operations of a four phase Urban Technology System (UTS) experiment designed to test technology innovation in local government are presented. These include: (1) a survey of the organizational and innovative climate in test and control sites; (2) an analysis of responses to questionnaires administered to the technology agents; and (3) a debriefing of agents on their technology transfer activities. Some preliminary conclusions about the ability of UTS to foster technological innovation in local government are made. GRA

N76-32073# Texas Transportation Inst., College Station.
EVALUATION OF A CHANGEABLE MESSAGE SIGN SYSTEM ON THE INBOUND GULF FREEWAY Final Report, Sep. 1974 - Aug. 1975
William R. Stockton, Conrad L. Dudek, Daniel B. Fambro, and Carroll J. Messer Aug. 1975 108 p refs
(PB-252255/5; TTI-2-18-75-200-1F) Avail: NTIS HC $5.50 CSCL 13B

Real-time changeable message signs that inform motorists of freeway traffic conditions are evaluated. Evaluation was accomplished through the use of a questionaaire suvey and a traffic operations analysis. Results showed that the changeable message signs were effective in providing information to the motorist. Considerable motorist diversion was noted during analysis incidents which were accompanied by a 'LANE BLOCKED' display. The signs were highly visible, generally understood, and useful within the constraints of corridor geometry. Lack of understanding of the letter-grade rating scale employed was attributed to the fact that the scale was not anchored to a readily understandable base. Questionnaire results showed that a vast majority of the respondents found the system useful.GRA

N76-32074# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
NETWORK MODEL STUDIES FOR AUTOMATED GUIDEWAY TRANSIT: ADVANCED GROUP RAPID TRANSIT MODELS Final Report
D. L. Kershner, R. C. Rand, and W. J. Roesler Feb. 1976 177 p refs
(Contract DOT-UT-30010)
(PB-251881/9; UMTA-MD-06-0018-75-3) Avail: NTIS HC $7.50 CSCL 13B

Network models were developed for the Urban Mass Transportation Administration (UMTA) of the Department of Transportation. This work resulted in the design of a series of network models representing possible Automated Guideway Transit (AGT) installations. The models, which include basic network geometries and trip-making characteristics, can serve as baseline network environments for conducting service/policy system-design trade-off studies and for designing and testing various system management algorithms. GRA

N76-32075# Transportation Research Board, Washington, D.C.
TRANSPORTATION AND LAND DEVELOPMENT POLICY
Philip Hammer 1976 80 p refs
(PB-253180/4; TRB/TRR-565; ISBN-0-309-02475-7) Avail: NTIS HC $6.00 CSCL 13B

The following topics are discussed: issues and actions for managing development; new frontiers for land development controls; joint development institutional constraints and potentials; transportation and land development; issues in national and state development policy; integrated economic social environmental planning; integrating land use and transportation planning in rebuilding city centers; coordination of urban development and planning and developing transportation facilities; suburban highways and roads as instruments of land use change; and directing the evolution of urban land use to achieve improved transportation system performance. GRA

N76-32076# Charles River Associates, Inc., Cambridge, Mass.
ESTIMATING THE EFFECTS OF URBAN TRAVEL POLICIES Final Report, Feb. 1975 - Mar. 1976
Frederick C. Dunbar Apr. 1976 196 p refs Sponsored in part by Office of the Assistant Secretary for Policy, Plans and Intern. Affairs (DOT), Washington, D. C.
(Contract DOT-TSC-964)
(PB-253208/3; DOT-TSC-OST-76-10) Avail: NTIS HC $7.50 CSCL 13B

Models and procedures are presented for quick evaluation of transportation policy options on urban travel behavior. The methods described can be used to estimate the travel demand effects of a wide variety of transportation policy instruments with currently available data in a matter of hours, or minutes, with the aid of a calculator. To evaluate the effects of a transportation policy, travel is separated into work and nonwork purposes. Both the work and nonwork trip demand models and procedures are exercised on sets of policy issues which are of current interest, including gasoline taxes, parking restrictions, transit service improvements and the introduction of new modes. GRA

88 SPACE SCIENCES (GENERAL)

N76-32077# Royal Observatory, Edinburgh (Scotland).
[ACTIVITIES OF THE ROYAL OBSERVATORY FOR THE YEAR ENDING 30 SEPTEMBER 1975] Annual Report
1975 29 p refs
Avail: NTIS HC $4.00

Activities during this period cover diffuse matter; microwave, infrared, X-ray and radio sources; stellar studies; multiple stellar systems; structure and evolution of the galaxy; and galaxy studies. Associated national facilities and an outstation at Monte Porzio (Italy), are described. ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-32078*# Transemantics, Inc., Washington, D.C.
NEUTRON STARS AND BLACK HOLES IN BINARY STAR SYSTEMS
N. I. Shakura NASA Jun. 1976 69 p refs Transl. into ENGLISH from Novoye v Zhizni, Nauka, Tekhnike, Ser. Kosmonavtika, Astronomiya (Moscow), 1976 p 1-62

(Contract NASw-2792)
(NASA-TT-F-17095) Avail: NTIS HC $4.50 CSCL 03A

A new class of astronomical objects has lately been discovered: binary systems with compact X-ray sources. In analyzing their properties, scientists concluded that such sources could be the neutron stars or black holes, predicted earlier by the theories of relativity and stellar evolution. A popular description is given of these unusual objects, which have significantly developed certain concepts in the field of astrophysics. Author

N76-32079*# Transemantics, Inc., Washington, D.C.
SPECTROPHOTOMETRY OF CLASS M STARS
L. D. Beshenova and A. V. Kharitonov NASA Jul. 1976 209 p refs Transl. into ENGLISH from Tr. Astrophys. Inst., Acad. Sci. Kazakh SSR (USSR), v. 27, 1975 p 1-208
(Contract NASw-2792)
(NASA-TT-F-17097) Avail: NTIS HC $7.75 CSCL 03A

Energy distribution in the spectra of 126 M class stars is studied in the region of 3,200 - 7,800 A. The observations were made on a photo-electric scanning spectrometer with a concave grate (the Seya-Namioka system). The results are expressed in absolute energetic units (erg/sq cm. sec. cm) with an averaging interval of 50 A. The method of the observations and processing, accuracy, and reliability of the obtained data are presented. The mean square error (MSE) of the monochromatic illuminations is 4.4 percent on the average through the region of 3,200 - 7,300 A and for all stars. Certain investigations of the mass of M stars have been carried out according to the histograms of energy distribution. A system of quantitative spectral classification of M stars based on measuring the depressions created by TiO bands is suggested. The accuracy of the classification is characterized by a MSE of 0.1 - 0.2 of the spectral subclass. Author

N76-32080*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LOW-FREQUENCY RADIO SURVEY OF THE PLANETS WITH RAE-2
M. L. Kaiser Aug. 1976 20 p refs Submitted for publication
(NASA-TM-X-71182; X-695-76-186) Avail: NTIS HC $3.50 CSCL 03A

Over one thousand occultations of each planet in the solar system have occurred during the period from mid-1973 through mid-1976 as seen from the lunar orbiting Radio Astronomy Explorer-2 (RAE-2) spacecraft. These occultations have been examined for evidence of planetary radio emissions in the 0.025 to 13.1 MHz band. Only Jupiter and the earth have given positive results. Lack of detection of emission from the other planets can mean that either they do not emit radio noise in this band or the flux level of their emissions and/or its occurrence rate are too low to be detected by RAE-2. Author

N76-32081*# Planetary Science Inst., Tucson, Ariz.
PLANETARY ASTRONOMY Final Report
15 Aug 1976 160 p refs
(Contract NASw-2843)
(NASA-CR-148862) Avail: NTIS HC $6.75 CSCL 03A

Color and spectral data from spectrometer observations and computerized analyses of asteroid spectra are discussed. Potential occultations of bright asteroids by the moon are summarized. Analysis of anisotropic scattering within Saturn's rings indicates that mineral contamination of the 120 particles cannot exceed 5 percent by weight, and that the rings formed from particle breakup rather than from particle condensation. Raman probe applications to Jupiter and Uranus atmospheres indicate the presence of aerosol particles. A review of Mariner 9 Mars cloud topography data establishes that most blue clouds are orographic uplift clouds composed of condensates, and that sporadic red clouds are associated with blue clouds or volcanoes and thus probably do not represent dust storm phenomena. G.G.

N76-32082# Owens Valley Radio Observatory, Pasadena, Calif.
EARTH-BASED OBSERVATIONS OF JUPITER: MILLIMETER TO METER WAVELENGTHS
G. L. Berge and S. Gulkis (JPL) 1976 146 p refs
(Contract N00014-67-A-0094-0019)
(AD-A023217; Rept-1976-4) Avail: NTIS CSCL 03/2

A comprehensive review of earth-based observations of the continuous radio emission from Jupiter in the wavelength range from 1 millimeter to 5 meters is presented. After a brief historical summary of the observations and early theories for the origin of emission, the article proceeds to give an up-to-date account of the observations including total intensity, polarization, brightness distribution, and variability measurements. An extensive table of measurements of the total flux density is included. The article presents the principal arguments demonstrating that the observed radiation arises partly from synchrotron emission by relativistic electrons trapped in Jupiter's magnetic field and partly from a thermal process in its atmosphere. The interpretation of the thermal emission component in terms of atmospheric emission is illuminated by showing weighting functions and limb darkening curves at a number of frequencies for specific model. Potential sources of microwave opacities in the Jovian atmosphere are discussed and the radiative transfer equations given. GRA

N76-32083# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE HANDLING OF STAR CATALOGS: THE TRANSFORMATIONS OF POSITIONS AND PROPER MOTIONS
Laurence G. Taff 17 Feb. 1976 40 p refs
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A023248; TN-1976-12; ESD-TR-76-40) Avail: NTIS CSCL 03/3

The procedures for performing precision corrections of stellar position and velocity vectors are presented. Both the effects of motion relative to the chosen coordinate system (i.e., the equatorial system) and motion of the coordinate system relative to inertial space are considered. Details are presented for using both rigorous formulas and power series expansions. Errors in the power series method are evaluated by actually applying the algorithm to the FK4 (1963; 1535 stars). In addition, instructions are given for performing updates at multiple epochs with a minimum of computation. GRA

N76-32084# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MOONRISE, MOONSET AND MOON PHASES FOR 1976 Meteorological Data Report
Darl G. McCullough Dec. 1975 20 p ref
(DA Proj. 1T6-65702-D-127)
(AD-A022780; DR-899) Avail: NTIS CSCL 03/2

Times of moonrise, moonset and moon phases at WSMR in 1976 are discussed: (1) Equinoxes, solstices and declination tables; (2) celestial sphere illumination due to the moon - times of sunset and sunrise; and (3) beginnings and endings of civil, nautical, and astronomical twilight times of moonrise, moonset and moon phases for 1976 according to months. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-32085 New York Univ., N.Y.
KINEMATIC EFFECTS OF RELATIVISTIC OBJECTS Ph.D. Thesis
William Wallace 1976 115 p
Avail: Univ. Microfilms Order No. 76-19560

Radio objects in quasars have been observed with apparent transverse velocities that exceed the speed of light. A model wherein such bodies are ejected from a quasar at relativistic speeds provides a possible explanation for the puzzling observational data. The kinematic effects associated with such an eject model are analyzed in detail. A geometrical construction for the observable parameters of relativistic motions in a Friedman universe is employed to study the resulting optical phenomena. Consideration of an eject in the form of an expanding spherical shell of matter leads to a generalization of the Penrose-Terrell theorem on the visual appearance of a moving object. As an illustrative example, the results obtained are applied to the case of the quasar 3C 279. Dissert. Abstr.

N76-32086*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH RESOLUTION MEASUREMENTS OF THE LOW STATE OF CYG X-1

R. E. Rothschild, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Aug. 1976 29 p refs Submitted for publication

(NASA-TM-X-71178; X-661-76-179) Avail: NTIS HC $4.00 CSCL 03B

Cyg X-1 was observed on two occasions separated by a year by the same X-ray rocket payload. High resolution temporal and spectral data reveal that Cyg X-1 was essentially unchanged in these two observations a year apart, with bursts of millisecond duration observed in the earlier flight and also, observed in the second. Analysis of these bursts has failed to reveal any internal temporal structure, either luminous or spectral. The shot noise character of temporal fluctuations on timescales approximately 1 second can be explained by the presence of exponential pulses with a fraction of a second time constant and a rate near 8 sec/1. The possible connection of these pulses with the bursts is examined. Author

N76-32087*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CONSEQUENCES OF USING NONLINEAR PARTICLE TRAJECTORIES TO COMPUTE SPATIAL DIFFUSION COEFFICIENTS

Melvyn L. Goldstein Sep. 1976 33 p refs Submitted for publication

(NASA-TM-X-71168; X-692-76-200) Avail: NTIS HC $4.00 CSCL 03B

The propagation of charged particles through interstellar and interplanetary space has often been described as a random process in which the particles are scattered by ambient electromagnetic turbulence. In general, this changes both the magnitude and direction of the particles' momentum. Some situations for which scattering in direction (pitch angle) is of primary interest were studied. A perturbed orbit, resonant scattering theory for pitch-angle diffusion in magnetostatic turbulence was slightly generalized and then utilized to compute the diffusion coefficient for spatial propagation parallel to the mean magnetic field, Kappa. All divergences inherent in the quasilinear formalism when the power spectrum of the fluctuation field falls off as K to the minus Q power (Q less than 2) were removed. Various methods of computing Kappa were compared and limits on the validity of the theory discussed. For Q less than 1 or 2, the various methods give roughly comparable values of Kappa, but use of perturbed orbits systematically results in a somewhat smaller Kappa than can be obtained from quasilinear theory. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-32088*# Transemantics, Inc., Washington, D.C.

SOVIET LITERATURE ON METEORITE CRATERS

NASA Aug. 1976 7 p refs Transl. into ENGLISH of "Sovetskaya Literatura po Meteoritnym Krateram" (unpublished report) Moscow, Acad. of Sci. USSR, 1976 6 p

(Contract NASw-2792)

(NASA-TT-F-17147) Avail: NTIS HC $3.50 CSCL 03B

This special bibliography lists 52 Soviet articles, reports and documents concerning meteorite craters. These were introduced into the NASA scientific and technical information system in July 1976. S.M.

N76-32089*# Texas Univ. at Dallas, Richardson.

LUNAR ATMOSPHERIC COMPOSITION EXPERIMENT Final Report, 1 Jun. 1971 - 30 Sep. 1975

John H. Hoffman 1975 132 p refs

(Contract NAS9-12074)

(NASA-CR-150946) Avail: NTIS HC $6.00 CSCL 03B

Apollo 17 carried a miniature mass spectrometer, called the Lunar Atmospheric Composition Experiment (LACE), to the moon as part of the Apollo Lunar Surface Experiments Package (ALSEP) to study the composition and variations in the lunar atmosphere. The instrument was successfully deployed in the Taurus-Littrow Valley with its entrance aperture oriented upward to intercept and measure the downward flux of gases at the lunar surface. During the ten lunations that the LACE operated, it produced a large base of data on the lunar atmosphere, mainly collected at night time. It was found that thermal escape is the most rapid loss mechanism for hydrogen and helium. For heavier gases, photoionization followed by acceleration through the solar wind electric field accounted for most of the loss. The dominant gases on the moosn were argon and helium, and models formed for their distribution are described in detail. It is concluded that most of the helium in the lunar atmosphere is of solar wind origin, and that there also exist very small amounts of methane, ammonia, and carbon dioxide. Author

N76-32090*# California Univ., Berkeley. Dept. of Physics.

HETERODYNE DETECTION OF CO2 EMISSION LINES AND WIND VELOCITIES IN THE ATMOSPHERE OF VENUS

A. L. Betz, M. A. Johnson, R. A. McLaren, and E. C. Sutton [1975] 15 p refs

(Grants NGR-05-003-452; NGL-05-003-272; NSF AST-75-20353)

(NASA-CR-148781) Avail: NTIS HC $3.50 CSCL 03B

Strong 10 micrometer line emission from (c-12)(o-16)2 in the upper atmosphere of Venus was detected by heterodyne techniques. Observations of the absolute Doppler shift of the emission features indicate mean zonal wind velocities less than 10 m/sec in the upper atmosphere near the equator. No evidence was found of the 100 m/sec wind velocity implied by the apparent 4-day rotation period of ultraviolet cloud features. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-32091# Naval Research Lab., Washington, D.C. Plasma Physics Div.

FORMATION OF FAST ELECTRON TAILS IN TYPE 2 SOLAR BURSTS Interim Report

M. Lampe and K. Papadopoulos Mar. 1976 24 p refs

(NRL Proj. H02-27)

(AD-A023063; NRL-MR-3247) Avail: NTIS CSCL 03/2

It is shown that low frequency turbulence, due to the modified two-stream instability excited in the front of a collisionless shock, can accelerate electrons to very large energies in the shock wake. This mechanism can produce nonthermal tails of the sort required to explain Type II solar bursts, contrary to previous conclusions. GRA

N76-32092*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

CORRELATION OF BOW SHOCK PLASMA WAVE TURBULENCE WITH SOLAR WIND PARAMETERS

Paul Rodriguez and Donald A. Gurnett Apr. 1975 65 p refs

(Contract NAS5-11074; Grants NGL-16-001-002; NGL-16-001-043; Contract N00014-68-A-0196-0009)

(NASA-CR-148738; AD-A021249; U-of-Iowa-75-18) Avail: NTIS HC $4.50 CSCL 04/1

The r.m.s. field strengths of electrostatic and electromagnetic turbulence in the earth's bow shock, measured in the frequency range 20 Hz to 200 kHz with IMP-6 satellite, are found to correlate with specific solar wind parameters measured upstream of the bow shock. GRA

N76-32093# Harvard Coll. Observatory, Cambridge, Mass.

ACTIVE REGION FLARE RATES AND 8.6 MILLIMETER BRIGHTNESS TEMPERATURES, 2 Interim Report

George L. Withbroe and Jorge E. Vernazza 1 Oct. 1975 22 p refs

(Contract F19628-74-C-0018; AF Proj. 8682)

(AD-A022680; Scientific-2; AFCRL-TR-75-0563) Avail: NTIS CSCL 03/2

The relationship between the flaring rate and 8.6 mm brightness temperatures of active regions has been analyzed. As the 8.6 mm brightness temperature of an active region increases, the energy released by the region is contained in larger and larger flares. At low temperatures subflares are dominant, at intermediate temperatures most of the events are either subflares or class 1 flares and at high temperatures class 2 or greater flares release most of the energy. The results of the study indicate that measurements of 8.6 mm brightness temperatures can be used to predict the rate of flaring of active regions. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-32094*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FINAL SAS-2 GAMMA RAY RESULTS ON SOURCES IN THE GALACTIC ANTICENTER REGION
D. J. Thompson, C. E. Fichtel, R. C. Hartman, D. A. Kniffen, and R. C. Lamb Aug. 1976 38 p refs Submitted for publication
(NASA-TM-X-71186; X-662-76-198) Avail: NTIS HC $4.00 CSCL 03B

Analysis of SAS-2 high energy Gamma ray data from the direction of the galactic anticenter shows that this region is characterized by: a diffuse emission from the galactic plane which has a maximum along b=0 deg and an enhancement toward negative latitudes associated with Gould's Belt, a strong point source in the direction of the Crab nebula, and a second intense localized source near galactic coordinates 195 deg, +5 deg. Gamma ray emission from the Crab source is dominated by a pulsed flux from PSR 0531+21. The total flux above 100 MeV is 3.7 + or - 0.8 million/sq cm s. The source near 195 deg, + 5 deg has a flux above 100 MeV of 4.3 + or - 0.9 million/sq cm s. Its spectrum appears flatter than that of the Crab. The diffuse galactic plane emission at negative lattitudes shows a general correlation with the local matter distribution associated with Gould's Belt. The calculated Gamma ray intensity agrees well with the SAS-2 observations. Author

N76-32095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RADIATION FROM CLUSTERS OF GALAXIES: SPECTRAL EVIDENCE FOR A HOT EVOLVED GAS
P. J. Serlemitsos, B. W. Smith, E. A. Boldt, S. S. Holt, and J. H. Swank Sep. 1976 12 p refs Submitted for publication
(NASA-TM-X-71189; X-611-76-205) Avail: NTIS HC $3.50 CSCL 03B

OSO-8 observations of the X-ray flux in the range 2-60 keV from the Virgo, Perseus, and Coma-Clusters provide strong evidence for the thermal origin of the radiation, including iron line emission. The data are adequately described by emission from an isothermal plasma with an iron abundance in near agreement with cosmic levels. A power law description is generally less acceptable and is ruled out in the case of Perseus. Implications on the origin of the cluster gas are discussed. Author

99 GENERAL

N76-32096*# Scientific Translation Service, Santa Barbara, Calif.
ESNAULT-PELTERIE AND ASTRONAUTICS
E. A. Brun Washington NASA Aug. 1976 8 p Transl. into ENGLISH of conf. paper, Intern. Academy of Astronautics, France, 1976 Proposed for presentation at the History Symposium, Alamogordo, 1976 p 1-5
(Contract NASw-2791)
(NASA-TT-F-17200) Avail: NTIS HC $3.50 CSCL 05D

The personal history of the French astronautics scientist Robert Esnault-Pelterie (1887-1957) is reported. Author

N76-32097# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1975-4
May 1976 80 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 189-244 Original French report available from ONERA, Paris FF 30
(ESA-TT-296) Avail: NTIS HC $5.00

Publications appear on the following subjects: temperature fields in a solid in permanent oscillatory regime; ONERA ARC II B wind tunnel improvements; microfactography of fatigue rupture surfaces of a nickel alloy and of two titanium alloys; vibration tests of an imperfectly linear structure; and problems related to small movements of an incompressible liquid in deformable tanks. For individual titles, see N76-32098 through N76-32102.

N76-32098 European Space Agency, Paris (France).
DETERMINATION OF THE TEMPERATURE FIELD WITHIN A SOLID IN PERMANENT OSCILLATORY REGIME c34
Jean Surugue, Emile LeGrives et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 1-16 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 189-200 (For availability see N76-32097 22-99)

A calculation method to describe the propagation inside a solid body of temperature oscillations due to periodic heat changes is developed. The question was raised in connection with phenomena of this nature in turbomachines. Numerical calculations show that with refractory blades protected by a thin coating of metallic oxide the temperature oscillations are so quickly damped that they are likely to have a very reduced effect, if any, on the resistance of the material. The calculation method presented, which was developed for various cases of plane slabs, may have broad applications. Author (ESA)

N76-32099 European Space Agency, Paris (France).
IMPROVEMENTS OF THE ONERA ARC 2 B WIND TUNNEL FOR REENTRY PLASMA STUDIES c09
Joel Fritz *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 17-32a refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 201-211 (For availability see N76-32097 22-99)

The development of the ARC 2 B wind tunnel during 1974 and its new performance are presented. The improvements concern the general performance of the wind tunnel: primary electron pollution, flow stability, test reproducibility, simulated altitudes, simulated velocities, model size. They also concern the means to measure the characteristics of the plasmas studied: electronic circuit of electrostatic probes, mechanical integration of microwave interferometers, and test of a new diagnostic, the Lecher line. The modifications aim mainly at updating the wind tunnel to hypervelocities (5 to 6,000 m/s) in order to face the problems raised by new programs. Author (ESA)

N76-32100 European Space Agency, Paris (France).
MICROFRACTOGRAPHY OF LOW-CYCLE FATIGUE RUPTURE SURFACES OF A NICKEL ALLOY AND TWO TITANIUM ALLOYS c26
Georges Vidal, Herve Duriez et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 33-46 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 213-222 (For availability see N76-32097 22-99)

The nickel alloy nimonic 90 and two titanium alloys, TA6V and TU2 were subjected at room temperature to low cycle fatigue tests, either in fluctuating tensile stress with constant extreme tensile loads or in rotary bending fatigue with constant extreme bending moments. The S-N curves were traced between 1/4 and about 10,000 cycles to breaking point. The S-N curve of nimonic 90 is discontinuous while those of TA6V and TU2 are continuous. Scanning electron microscope microfractographic examination revealed that the fractures are either quite identical

with cuplike static fractures, or initiated by one or several breaking starts without cups and sometimes with striations. Author (ESA)

N76-32101 European Space Agency, Paris (France).
THE VIBRATION TEST OF AN IMPERFECTLY LINEAR STRUCTURE **c39**
Rolland Dat *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 47-54 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 223-227 (For availability see N76-32097 22-99)

Vibration testing of nonlinear structures is discussed. The test methods used for identifying structures are based mainly on the linearity assumption and are inappropriate when the structure tested is imperfectly linear. It is shown that a slight stiffness nonlinearity is sufficient for the modal characteristics to become erroneous. The errors concern mostly the generalized masses. The sensitivity of the results to nonlinearities depends on the testing method used: it can be reduced by avoiding working too close to resonances or by introducing linear dissipation forces. Author (ESA)

N76-32102 European Space Agency, Paris (France).
NONHOMOGENEOUS, LINEARIZED PROBLEMS RELATED TO SMALL MOVEMENTS OF INCOMPRESSIBLE LIQUID IN DEFORMABLE TANKS **c34**
Jacques Leclerc, Pierre Salaun et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-4 (ESA-TT-296) May 1976 p 55-75 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-4, Jul. - Aug. 1975 p 229-244 (For availability see N76-32097 22-99)

The forced motion of a flexible tank, filled with a liquid, under the action of external forces applied to the tank or an imposed entrainment motion, was studied. Existing work on free vibrations of a rigid or elastic tank containing a liquid was recalled briefly and a general method for the study of forced vibrations of such a system is presented. Two important particular cases were considered: that in which external forces were imposed and that in which the tank was subjected to an entrainment movement. This latter case, applied to shipborne tanks, leads to particular methods; its practical interest is obvious. Author (ESA)

N76-32103# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1975-5
May 1976 173 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 245-312 Original French report available from ONERA, Paris FF 30
(ESA-TT-298) Avail: NTIS HC $6.75

Publications appear on the following subjects: long range optimal interception applied to initial guidance in a vertical plane; linear quadratic differential games theory applied to optimal three-dimensional interception; unsteady flow measurements in turbocompressors; response of a solid propellant to a pressure step; contactless interferometric sensor for structural vibration measurement; mathematical model of vibration induced by vortex shedding. For individual titles, see N76-32104 through N76-32109.

N76-32104 European Space Agency, Paris (France).
LONG RANGE OPTIMAL INTERCEPTION. ANALYTICAL APPROACH AND APPLICATION TO INITIAL GUIDANCE IN A VERTICAL PLANE **c13**
Nguyen X. Vinh and Jean-Pierre Peltier *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 1-29 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 245-254 (For availability see N76-32103 22-99)

The equations of motion for a guided missile in powered flight within an exponential atmosphere over the earth's surface, which is assumed to be flat, are presented, using a system of non-dimensional variables. Two examples of optimal trajectories are given. The problem of optimal interception, subject to constraint on the attainable load factor was investigated. It is shown that the optimization of the total trajectory can be reduced to the optimization of the initial ascent phase. Author (ESA)

N76-32105 European Space Agency, Paris (France).
AN APPROACH TO THE PROBLEM OF OPTIMAL THREE-DIMENSIONAL INTERCEPTION BY THE THEORY OF LINEAR QUADRATIC DIFFERENTIAL GAMES **c13**
Claude Aumasson *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 30-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 255-266 (For availability see N76-32103 22-99)

The problem of optimal three-dimensional interception was modeled in the form of a differential game. The linearization of trajectories which are nearly uniform and rectilinear, the choice of a fixed duration for the interception and of a performance index equal to the square of the terminal distance, weighted by integral penalties related to the lateral accelerations, make it possible to apply the theory of quadratic linear differential games and to obtain closed loop optimal guidance laws for the pursuer as well as for the evader. The weighting coefficients in the performance index are related to the maximum lateral accelerations experienced by the two moving bodies. The terminal distance is explicitly expressed as a function of these coefficients and of the interception time. Author (ESA)

N76-32106 European Space Agency, Paris (France).
UNSTEADY FLOW MEASUREMENTS IN TURBOMACHINES **c02**
Robert Larguier and Alexandre DeSievers *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 61-86 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 267-277 (For availability see N76-32103 22-99)

Unsteady flow in the rotor, downstream of the rotor, and in the guide vanes of a compressor was measured. The configuration of the shock waves in the rotor of a supersonic compressor was derived from an isobar chart produced by means of a number of pickups having a short response time. The lines representing the shock waves obtained by instantaneous schlieren photography agree well with the corresponding isobar chart. Pressure measurements on the rotor blades were obtained from a subsonic rotor test-rig. The wakes downstream of the rotor were explored using a fixed hot-wire anemometer, a fixed cylindrical pressure probe, and a rotary probe connected to the rotor. The unsteady boundary layer on a guide vane was characterized by means of hot-film wall gages. Under the test conditions employed, the boundary layer had a laminar nature over a portion of the suction surface, during a part of the period between successive blade passes. Author (ESA)

N76-32107 European Space Agency, Paris (France).
RESPONSE OF A SOLID PROPELLANT TO A PRESSURE STEP **c20**
Jean Brulard, Paul Kuentz, and Roger Kling *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 87-109 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 279-287 (For availability see N76-32103 22-99)

The response of the combustion zone of a solid propellant to a large amplitude pressure step was studied on twin chambers, the rupture of a separating membrane generating a positive step in the low-pressure chamber and a negative step in the high-pressure chamber. Burning rates for the transient state were deduced from the pressure curves by application of the fundamental laws of conservation, the heat flux transmitted at the surface being established using the Zel'dovich hypothesis. An interpretation of the results is given; this interpretation is based mainly on the difference between the characteristic times of the gaseous and solid phases in the case of the positive step and on the changes in surface condition and flame structure in the case of the negative step. Author (ESA)

N76-32108 European Space Agency, Paris (France).
INTERFEROMETRIC SENSOR FOR THE MEASUREMENT OF VIBRATIONS OF MECHANICAL STRUCTURES **c35**
Michel Philbert and Gerard Dunet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 110-137 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 289-299 (For availability see N76-32103 22-99)

A contactless interferometric sensor for structural vibration measurement was developed. The difficulties inherent in interferences in scattered light, (speckle phenomenon) and the methods used to remedy them, were studied and the sensor and its operation is described. Some experimental results are presented, in particular those for a blade excited torsionally and on a helicopter main gear box. Author (ESA)

N76-32109 European Space Agency, Paris (France).
MATHEMATICAL MODEL OF THE VIBRATION INDUCED BY VORTEX SHEDDING **c02**
Edmond Szechenyi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-5 (ESA-TT-298) May 1976 p 138-168 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-5, Sep.-Oct. 1975 p 301-312 (For availability see N76-32103 22-99)

A mathematical model to allow for the lift forces a blunt cylindrical body experiences under the action of a flow perpendicular to its axis was established. The response of the structure to be calculated is accounted for. The model is based on simple physical concepts. It also makes use of the results of experiments carried out at high Reynolds numbers. The agreement between calculation and experiment is satisfactory for a test performed in a wind-tunnel on a flexible cylinder. Author (ESA)

N76-32110# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1975-6
Jul. 1976 107 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 313-367 Original French report available from ONERA, Paris FF 30
(ESA-TT-306) Avail: NTIS HC $5.50

Publications appear on the following subjects: trajectory restitution of missiles; numerical calculation of transonic cascade flow; conservative relaxation method for transonic flow; propane combustion; and heat resistant alloys prepared by powder metallurgy. For individual titles, see N76-32111 through N76-32115.

N76-32111 European Space Agency, Paris (France).
TRAJECTORY RESTITUTION OF MISSILES OF ARBITRARY CHARACTERISTICS **c13**
Huu Thanh Huynh, Dominique Biausse, and Francoise Depasse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 1-29 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 313-326 (For availability see N76-32110 22-99)

A method for determining the actual trajectory of a missile of arbitrary characteristics, making use only of measurements provided by the launching range tracking means, is described. The use of techniques derived from the theory of linear filtering and smoothing made it possible to take into account all available measurements. A stochastic mathematical model was established to represent the missile evolution. The method was validated by a numerical simulation, where the trajectory to be restituted was that of a missile with two propulsive stages. The stable behavior of the estimator in the configurations considered, especially during the extinction and ignition phases, makes it possible to expect a good restitution of actual trajectories, with a better precision than that provided by conventional techniques, such as polynomial smoothing or the least squares method.
Author (ESA)

N76-32112 European Space Agency, Paris (France).
NUMERICAL CALCULATION OF THE TRANSONIC FLOW OF IDEAL FLUID THROUGH CASCADES **c02**
Jean-Pierre Veuillot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 30-52 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 327-338 (For availability see N76-32110 22-99)

The calculation of steady, transonic flow with shocks of ideal fluids through a quasi three-dimensional cascade was made by an unsteady method. The boundary condition being given, the steady solution was obtained as the limit, for long periods, of the solution of the Euler equations written, in unsteady form, on a stream sheet of meridian flow. After transformation of the physical plane into a calculation plane, the numerical integration was ensured by a finite difference scheme of the predictor-corrector type, permitting the determination of the shocks by a method of artificial viscosity. Applications to various types of cascades are presented. Author (ESA)

N76-32113 European Space Agency, Paris (France).
A FULLY CONSERVATIVE RELAXATION METHOD FOR TRANSONIC FLOW **c02**
Jean-Jacques Chattot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 53-68 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 339-346 (For availability see N76-32110 22-99)

A relaxation method for first order partial differential equations of mixed type such as encountered in transonic inviscid aerodynamics is presented. A definition of conservative schemes is proposed by which the shock operator of Murman is recovered. It is shown that in the method of Steger and Lomax the discretization of the derivative delta/delta z is not conservative according to this definition, and a modification is proposed to enforce a conservation property. A new approach of a solution by relaxation first order systems is presented. The discretization of the derivative delta/delta z is simpler. Results obtained with this method in the case of small perturbation equations for the velocity components in transonic flows are presented for the case of direct and inverse calculations. Author (ESA)

N76-32114 European Space Agency, Paris (France).
PROPANE COMBUSTION IN A PERFECTLY STIRRED COMBUSTOR **c25**
Jean Duterque and Roland Borghi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 69-90 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 347-357 (For availability see N76-32110 22-99)

Propane combustion is studied to give a quantitative definition of quasi global reactions during combustion. Particular attention was paid in the case of lean mixtures to two main steps which explain fairly satisfactorily the appearance and then the disappearance of CO. Nitrous oxide formation is studied in the flame itself where there is substantial formation of NO2, which is then tranformed into NO. Author (ESA)

N76-32115 European Space Agency, Paris (France).
FABRICATION BY POWDER METALLURGY OF HEAT-RESISTANT SUPERALLOYS **c26**
Andre Hivert, Andre Walder, and Michel Marty *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-6 (ESA-TT-306) Jul. 1976 p 91-103 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-6, Nov.-Dec. 1975 p 359-367 (For availability see N76-32110 22-99)

Fabrication of heat resistant nickel base superalloy IN 100 is reported. The technique applied for powder fabrication (rotating electrode, atomization in argon), and the process applied to give the required alloy density (extrusion, isostatic pressure, rapid isostatic compaction) were found to be important. The mechanical properties were assessed in comparison with those of the cast alloy of the same composition (tensile and creep strength). Mechanical stability, although excellent at low and medium temperatures, is inadequate at high temperature, despite the improvements through heat treatment. Alloys produced by simpler densification through hot isostatic compression appear to be superior to extruded alloys. Author (ESA)

N76-32116# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1975-3
Jul. 1976 150 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 127-188 Original French report available from ONERA, Paris FF 30
(ESA-TT-307) Avail: NTIS HC $6.00

Publications appear on the following subjects: optimization of the final positioning of a geostationary satellite; turbulent near wake flow at supersonic speed; nonlinear pseudo splines; visualization of compressor flow; dry friction vibration tests;

acceleration potential theory applied to helicopters. For individual titles, see N76-32117 through N76-32122.

N76-32117 European Space Agency, Paris (France).
ANALYTICAL OPTIMIZATION OF THE FINAL POSITIONING OF A GEOSTATIONARY SATELLITE WITH OPERATIONAL CONSTRAINTS **c13**
Claude Aumasson and Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 1-39 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 127-143 Presented at Symp. on Optimization Problems in Eng. and Econ., Naples, 16-20 Dec. 1974 (For availability see N76-32116 22-99)

The final positioning of a spin stabilized geostationary satellite is optimized taking into account the operational constraints concerning the rendezvous duration and the direction of the axis of spin. Linearized calculus allows us to obtain, for each of the three rendezvous modes studied, an analytical expression for the correction impulses in terms of the deviations to be removed. Author (ESA)

N76-32118 European Space Agency, Paris (France).
BEHAVIOUR OF A TURBULENT NEAR-WAKE FLOW AT SUPERSONIC SPEED **c02**
Jean-Paul Dussauge and Jean Gaviglio *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 40-61 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 145-154 (For availability see N76-32116 22-99)

The axisymmetric turbulent near wake at Mach number 2.3 was studied experimentally in order to obtain information on the behavior of turbulent supersonic flows with strong pressure gradients. The mean velocity and density were determined from the pressure and temperature fields. The mean turbulent shear stresses and the turbulence production were deduced from these, using simplified continuity and momentum equations. The results show a significant decrease in production under expanding flow conditions, and a large increase in shear stress and production when the mixing layer undergoes a compression; they also show a decrease of these quantities downstream of the recirculating flow region. The results are discussed and compared with those obtained in low speed flows. Author (ESA)

N76-32119 European Space Agency, Paris (France).
NONLINEAR PSEUDO-SPLINES **c64**
Pierre Diringer *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 62-83 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 155-163 Presented at the Symp. on Technical and Scientific Numerical Calculation Methods, Paris, 18-20 Nov. 1974 (For availability see N76-32116 22-99)

A calculation algorithm is presented for determining an open curve constrained by given tangents at its ends, or a closed curve, with continuous slope and curvature, passing through a set of given points. The curvature (intrinsic parameter) was assumed to vary linearly along the abscissae of each chord. Thus a solution was obtained very close to that of nonlinear splines giving precise results that can be used either for interpolating or for calculating derivatives (slope and curvature). Author (ESA)

N76-32120 European Space Agency, Paris (France).
VISUALISATION OF THE FLOW IN A SUPERSONIC AXIAL COMPRESSOR WITH LONG BLADES **c09**
Guy Fertin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 84-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 165-168 (For availability see N76-32116 22-99)

Optical equipment developed for demonstrating the structure of the aerodynamic flow inside an experimental supersonic axial compressor with long twisted blades mounted on a strongly curved hub is described. The visualization method adopted is that of shadowgraph photography; to ensure a clear definition of the shadows, four of the interblade channels of the rotor are equipped with a retrodiffusing coating which has exactly the same shape as the hub. The aerodynamic field is illuminated through an observation window by means of a flash source synchronized with the moving blades, which thus allows a stroboscopic observation of the flow. Stereoscopic photographs can, to some extent, allow the position of the apparent contour of the shock surface to be localized in depth. The optical apparatus developed, the recording techniques used and some of the results obtained in this particular type of installation are discussed. Author (ESA)

N76-32121 European Space Agency, Paris (France).
VIBRATION TESTS OF A STRUCTURE WITH DRY FRICTION **c37**
Rolland Dat, Raymond Tretout, Jean-Marie Lafont et al *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 94-106 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 169-174 (For availability see N76-32116 22-99)

The influence of dry friction can be significantly reduced by the application of an auxiliary periodic excitation at high frequency. It can be shown that such a technique gives the structure a linear behavior for any excitation at a frequency much lower than that of the auxiliary frequency. This technique was used operationally in ground vibration tests of aircraft. Results obtained in the laboratory and in the field are shown. Author (ESA)

N76-32122 European Space Agency, Paris (France).
INTRODUCTION OF UNSTEADY SEPARATION INTO ACCELERATION POTENTIAL THEORY. APPLICATION TO HELICOPTERS **c02**
Jean-Joel Costes *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-3 (ESA-TT-307) Jul. 1976 p 107-145 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-3, May-Jun. 1975 p 175-188 (For availability see N76-32116 22-99)

The unsteady aerodynamic forces on a lifting surface in the presence of flow separation are predicted using a semi-empirical method. The three-dimenional effects were taken into account by means of the acceleration doublet method. The flow separation was represented by tests on a profile oscillating in a two dimensional flow. Application to a helicopter rotor yielded satisfactory results when unsteady phenomena were taken into account. Author (ESA)

N76-32123# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
[RESEARCH ACTIVITIES IN FRACTURE MECHANICS] Annual Report, 1975
[1976] 44 p refs In GERMAN
Avail: NTIS HC $4.00

The principle aim of the Institute is fracture mechanics research, subdivided into the fields of stress analysis and fracture strength. The scientific-technological goal is damage prevention by improvement of the safety of constructions. ESA